#2

INSTRUCTION BOOK NO. GA500

INDICATING OR RECORDING SERIES 500

ABSOLUTE-PRESSURE GAUGE

SERIAL NO._____ CUST. ORDER NO._____

RECORDING
INDICATING
CONTROLLING
TELEMETERING

INSTRUMENTS

BRISTOL'S

THE BRISTOL COMPANY
WATERBURY 20, CONN.

PLACE THESE INSTRUCTIONS WITH THE MAN IN CHARGE OF YOUR INSTRUMENTS

I M P O R T A N T

1. Read these instructions NOW before installing instrument.

2. Keep these instructions permanently & accessibly filed for future reference.

3. Be sure to specify MODEL & SERIAL numbers when ordering parts, instructions, diagrams or data.

4. Ship instruments or parts for repair or exchange only to Bristol's main or branch factories—not to Sales Offices.

5. Be sure to—
   1. Identify your shipments with your exact return address & order number.
   2. Write nearest Bristol Factory or office giving your order number, directions & address for return shipment, full instructions for repair, etc.

6. Report damage to shipments at once to shipping company. The *customer assumes responsibility for collecting any claim for damages* from the shipping company, on all shipments made on a collect basis.

WHO WILL SERVICE YOUR BRISTOL INSTRUMENT?

Divided responsibility produces misunderstanding and inattention. We therefore urge that all Bristol instruments in your plant be assigned to the care of one responsible man. He will rapidly become so familiar with routine chart changing, inking, checking and adjusting necessary to keep instruments in good working order, as to require only a few minutes time per day. Bristol will be pleased to supply additional information or personal instruction to instrument service men.

THE BRISTOL COMPANY
WATERBURY 20, CONN., U.S.A.

INDEX PAGE GA500
ISSUE NO. 3 OF 3/60

INSTRUCTION BOOK NO. GA500

ISSUE NO. 3

INDICATING OR RECORDING SERIES 500

ABSOLUTE-PRESSURE GAUGE

FOR SERIAL NO._____ CUST. ORDER NO._____

INDEX PAGE

THIS BOOK CONTAINS THE FOLLOWING INSTRUCTIONS IN THE FOLLOWING ORDER

ORDER IN BOOK	TITLE	NUMBER
1	Installation, Operation & Service Absolute-pressure Gauge	G6020A
2	Case Unpacking & Installation	Y19800
3	Recording-system Operation & Service	Y19802
4	Parts List for Absolute-pressure Gauge	G6025
5	Parts List for Case & Recording Accessories	Y19807
6	Mounting Dimensions	Y19809
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
	PLUS FOLLOWING ITEMS AS REQUIRED	
	SPECIAL INSTRUCTIONS	
		B2030
		B2032
		B2035-A
	WIRING DIAGRAMS	
LAST	ADDRESS & PHONE NUMBERS BRISTOL'S BRANCH FACTORIES & OFFICES	W 18220

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INSTRUCTION NO. G6020-A

(Replaces issue of 2/59)

INSTALLATION, OPERATION AND SERVICE SERIES 500 ABSOLUTE PRESSURE GAUGE 1957 DESIGN

TABLE OF CONTENTS

	Page
PART I GENERAL	3
A. Measurement of Vacuum and Absolute Pressure	3
B. Description	3
PART II INSTALLATION	3
A. Location	3
B. Gauge Tubing or Piping	3
C. Damping of Pulsating Pressures	4
D. Seals	4
PART III OPERATION	5
A. Overrange Pressure	5
PART IV SERVICE	5
A. Testing for Leaks	5
B. Calibration	5
C. General Service	5
D. Correspondence and Shipping	5

THE BRISTOL COMPANY WATERBURY 20, CONNECTICUT

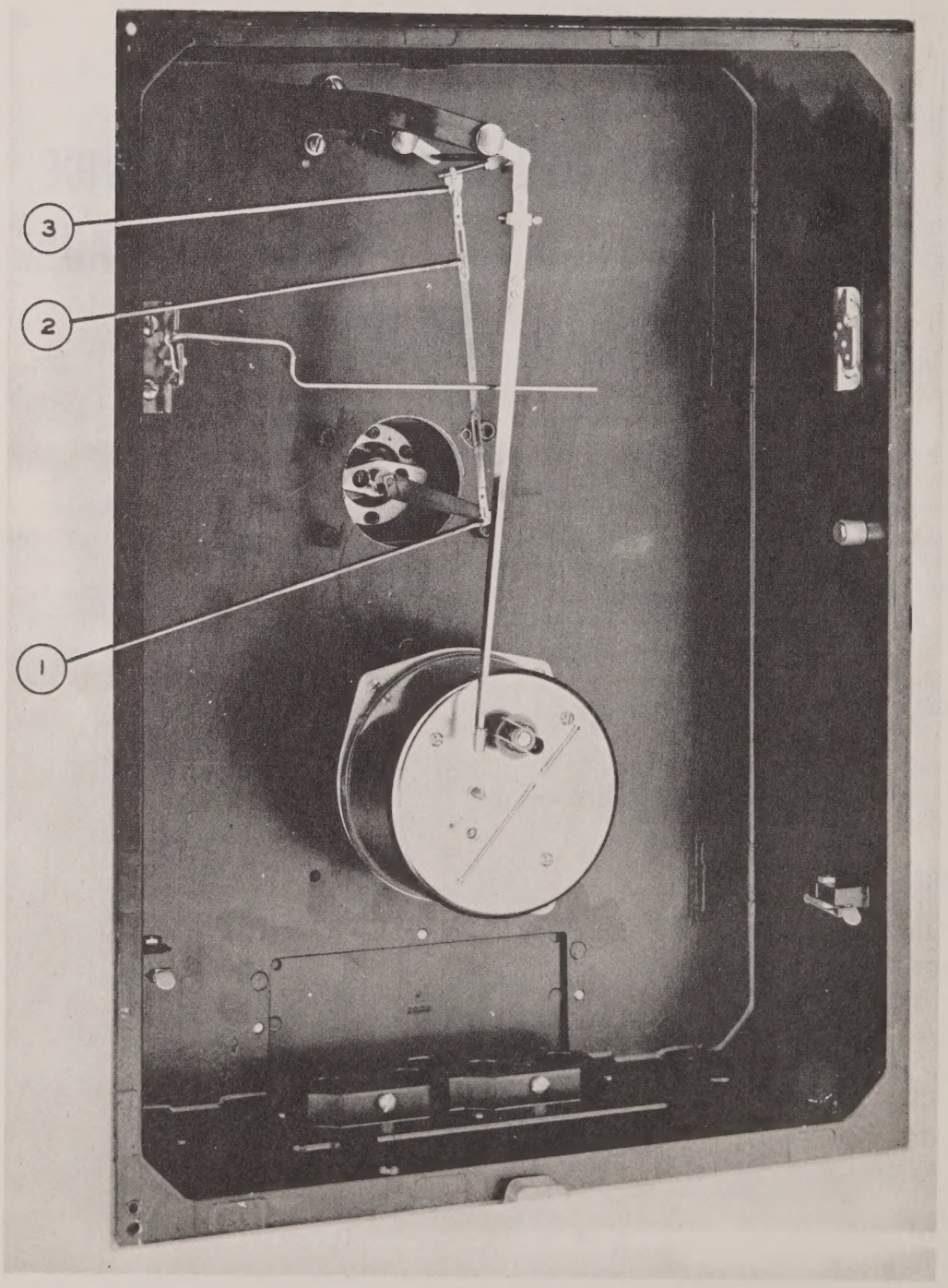

FIGURE 1. TYPICAL ABSOLUTE PRESSURE GAUGE

CODE TO FIGURE 1

1. Zero Adjustment Tab
2. Linearity Adjustment
3. Span Adjustment

NOTE: This instruction covers only the Series "500" Absolute Pressure Gauge and its measuring element. See separate instructions covering the recording system, controlling system, etc., as required.

PART I GENERAL

A. Measurement of Vacuum and Absolute Pressure

The measurement of a vacuum (in units of vacuum) is always made in relation to atmospheric pressure, the atmospheric pressure being considered as zero vacuum. Thus a full vacuum is always equal to the barometric pressure at the time of measurement.

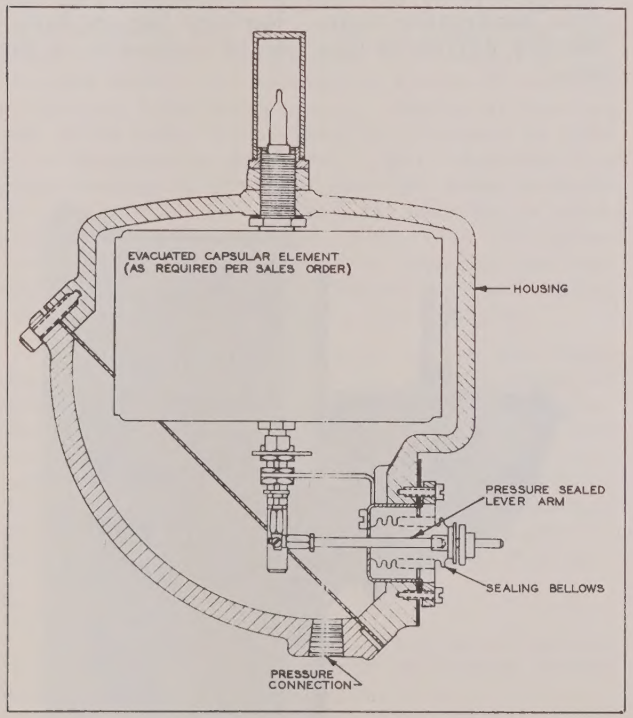

FIGURE 2. CROSS SECTION OF MEASURING ELEMENT

The measurement of absolute pressure with Bristol's Absolute Pressure Gauge is not affected by changes in atmospheric pressure. In this type of measurement, the zero pressure is at full vacuum.

The Series "500" gauge is the direct-reading, mechanical type designed to provide consistently high accuracy under industrial operating conditions. Pressures from absolute zero to normal atmospheric pressure can be measured, indicated or recorded and controlled.

B. Description

The pressure-tight housing encloses a completely evacuated capsular element. The pressure-tight lever arm (Refer to Fig. 2) is frictionless because it uses wire flextures rather than journal bearings or knife edges. It is constructed so that changes in atmospheric pressure cause no turning moment of the mechanism.

The multiplying lever system connecting the pen arm to the measuring element is protected against sudden loss of vacuum by a yielding spring arrangement of connecting link (item 3, Figure 1).

When the pressure in the housing is atmospheric, the capsular element is tightly compressed for ranges under 300 mm of mercury absolute. As the pressure in the housing is reduced (vacuum increased) by the process, the bellows gradually expands and the pen records the correct absolute pressure.

PART II INSTALLATION

A. Location of Instrument

Select a location as free as possible from dust, dirt, corrosive fumes, vibrations and extremes in temperature.

The absolute pressure gauge may be mounted on a wall or panel, and should be as close as possible to the measuring point in order to prevent delayed response or inaccuracies due to long connecting tubing.

B. Gauge Tubing or Piping

1. Size and Length. The following table gives recommended length and size of gauge lines for various ranges:

ABSOLUTE PRESSURE RANGE	LENGTH OF GAUGE LINE	RECOMMENDED SIZE	
		STANDARD PIPE	TYPE K COPPER TUBING
0 to 25 mm Hg (0 to 1 in. Hg)	up to 10 feet	1/4"	3/8"
	10 to 25 feet	1/2"	5/8"
	25 to 50 feet	3/4"	1"
25 to 760 mm Hg (1 to 30 in. Hg)	up to 25 feet	1/4"	3/8"
	25 to 100 feet	1/2"	5/8"

2. Connection. There must be absolutely no leaks in the gauge lines. Copper tubing with sweat fittings is recommended over iron or brass pipe.

Ream out the ends of the tubing or pipe and clean the inside throughly by using a solvent and blowing out with compressed air.

Use a pipe-sealing compound with brass or iron pipe fittings. They must be absolutely vacuum tight.

3. Condensate Trap in Gauge Line. It is always advisable to install a condensate trap in the gauge line. It should be located at the lowest point in the tubing connecting the process and measuring element. See typical installation diagram Figure 4.

4. Manual Vacuum Valve in Gauge Line. It is often convenient to have a valve in the gauge line in order to facilitate service or removal of the instrument. The valve should be the vacuum type and should be located near the instrument as shown in the typical installation diagram Figure 4.

C. Damping of Pulsating Pressures

Pulsating pressures will usually produce unreadable chart records and cause excessive wear on measuring systems. They can be damped out by installing capacity tanks, restrictions or using standard pulsation dampers.

A 1/4" needle vacuum valve in the gauge line can be used as a restriction. A capacity tank can be made from a piece of 2 inch pipe capped at both ends, tapped, and connected to a tee in the gauge line near the instrument.

D. Seals

Absolute pressure gauges cannot be sealed from the process in the usual way in which standard pressure gauges are sealed. If corrosive vapors get into the absolute pressure gauge lines, they may often be condensed by using a refrigerated trap (see Fig. 4). This may be a loop of the gauge line submerged in some cooling medium such as dry ice, or a standard refrigerated condensate trap. Mercury vapors from a mercury diffusion pump can be condensed in this way.

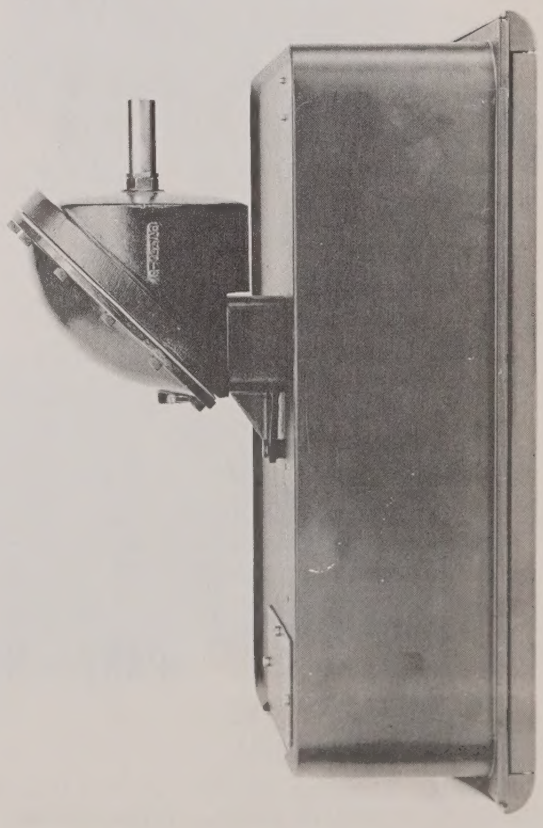

FIGURE 3. SIDE VIEW OF ABSOLUTE PRESSURE GAUGE

PART III OPERATION

See separate instructions on the operation of the recording and controlling system (if any).

A. Overrange Pressure

Do not subject the absolute pressure gauge to more than 10 psi above normal atmospheric (or 24.7 psi absolute) pressure. If pressures greater than 10 psi are to be applied to the process, a vacuum valve should be installed in the gauge line so that it may be turned off.

PART IV SERVICE

A. Testing for Leaks

Slow leaks in vacuum systems are difficult to detect. If there is a reason to suspect a leak in the capsular elements (Fig. 2), the capsular elements may be tested by connecting the gauge to a good vacuum pump and reducing the pressure within the housing to within 30 microns of mercury (.030 mm mercury). Notice if the pen goes below zero, then allow the pressure to come up to atmospheric pressure. Again evacuate the gauge housing to absolute zero and observe where the pen goes. If it goes farther below zero than it did on the first test, this indicates that the capsular element is leaking and the entire gauge should be returned to the Bristol Company's Waterbury factory for service.

If there is no difference in the pen readings in these tests, allow the gauge housing to stand at atmospheric pressure for 24 hours. Then evacuate the housing to absolute zero and notice where the pen goes. If it again goes only slightly below zero by the same amount as in previous tests, the linkage has been shifted and may be corrected by resetting the pen to zero with the microadjustment (item 1, Fig. 1).

B. Calibration

The instrument has been carefully calibrated at the factory and no further adjustment should be necessary.

If a zero check is desired, it may be made by connecting a laboratory type vacuum pump directly to the gauge. The vacuum pump must be capable of reducing pressure to within 30 microns of mercury. With 30 microns pressure, the recording pen should read zero. If it does not read zero, adjust zero adjuster (item 1, Fig. 1).

C. General Service

Except for routine cleaning and checking, Bristol's Absolute Pressure Gauge should be returned to the factory for repair, change of range or recalibration. Always send the complete instrument.

D. Correspondence and Shipping

Send all correspondence and orders to the nearest branch office. Send parts and instruments for repair or exchange only to Bristol's Waterbury factory, not to the branch offices. Be sure to state the model and serial number of the instrument in any order, correspondence or shipment.

The offices and factories of the Bristol Company are listed on a separate sheet included with each set of instructions.

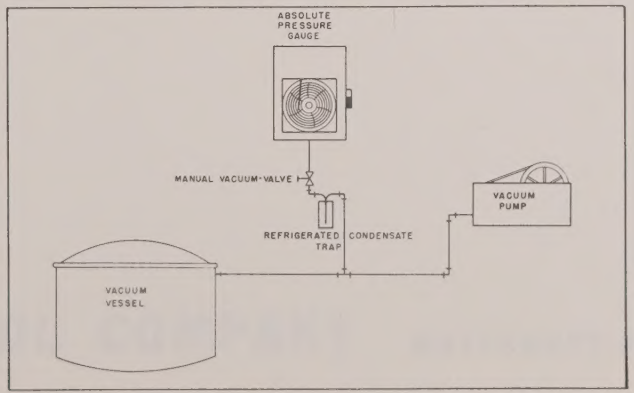

FIGURE 4. TYPICAL INSTALLATION DIAGRAM

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INSTRUCTION NO. Y19800

(Issue No. 5 of 6/54)

INSTALLATION AND SERVICE OF BRISTOL'S STANDARD MODEL 500 AND 530 CASES

TABLE OF CONTENTS

	Page
PART I GENERAL	2
A. Description	2
B. Accessories	2
PART II INSTALLATION	2
A. Location	2
B. Mounting the Case	2
1. Surface Mounting	2
2. Flush Mounting	2
3. Flush Mounting (Special)	2
PART III CASE CONNECTIONS	3
A. General	3
B. Standard Connection Sequence	3
C. Color Coding for Multiple-pen Recorders	3
D. Air-control Connections	3
E. Case-connection Fittings	3
PART IV CASE CHANGES AND SERVICE	3
A. General	3
B. Changing from Back to Bottom Connected	3
C. Changing from Bottom to Back Connected	4
D. Service and Repair	4

THE BRISTOL COMPANY WATERBURY 20, CONN.

PART I GENERAL

A. Description

Bristol's Model 500 and 530 Cases include many valuable features, such as uniformity of design and function, interchangeable mounting accessories (surface or flush), universal connection plates, etc. Case sizes are based on the nominal chart or dial dimensions. The Model 500 case is called the 12" case, and the Model 530 is called the 8" case.

B. Accessories

All Bristol Instruments are provided with mounting accessories for surface or flush mounting as specified on the sales order. In addition, other accessories, such as fixtures, extra parts, etc., may be supplied. These are always packed with the instrument and are itemized on the packing list. Do not throw away the packing until everything has been located and identified.

PART II INSTALLATION

A. Location of the Instrument

Select a location as free as possible from dust, dirt, corrosive fumes, vibration and extremes of temperature. Although Bristol instruments will operate satisfactorily under unfavorable conditions, the life and effectiveness of the instrument can be prolonged by using a recommended location.

B. Mounting the Case

Always mount the case vertically and level. Use a spirit level or plumb bob to check this. See Instructions Y19809 for mounting dimensions.

1. Surface Mounting. Surface mounting refers to any vertical surface, such as a wall, bracket or any other structure upon which the instrument may be fastened. Drill three 5/16" holes to take 1/4" bolts or wood screws according to mounting-dimensions drawing.

Attach the three brackets to the instrument in the surface-mounting position as shown in Figure 1 and fasten it securely to the surface.

2. Flush Mounting. Flush mounting means inserting the entire instrument into an opening so that only its door protrudes beyond the surface of the panel, wall or other mounting place. Cut out the hole in panel according to mounting-dimensions drawing. The maximum thickness of the panel cannot exceed 1 7/8" except for the bottom-connected 4-pen recorder with electric chart drive; this panel thickness cannot exceed 5/8".

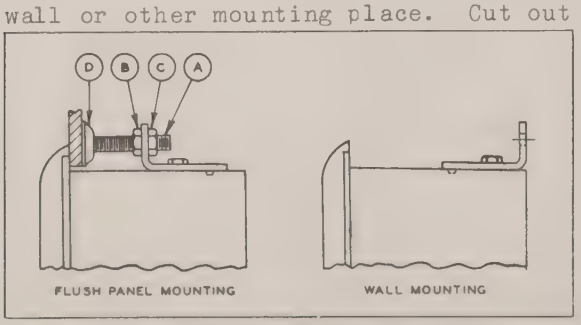

FIGURE 1. MOUNTING BRACKET POSITIONS

Allow horizontal space between instruments as specified in the mounting dimensions to give door clearance. Vertical space between instruments should not be less than 5" when they are flush mounted, back connected. Allow more between bottom-connected instruments.

After the hole is cut in the panel, remove the mounting bracket from the top of the case, unscrew all case connections (except thermometer tubing and filled pressure seals - see paragraph 3 below), and insert the back of the instrument thru the hole, bottom first. On thicker panels it may be necessary to remove all three mounting brackets. Have someone hold the instrument in front while the brackets are being replaced. After mounting brackets are replaced, loosen nuts B and C and screw A. Force screw A against reinforcing disc D. Turn nut B until snug against mounting bracket. Tighten screw A Lock in place by tightening nut C with a wrench. It is not necessary to tighten nut B with a wrench.

3. Flush Mounting of Bottom-connected Thermometers and Pressure Gauges with inseparable pressure seals. Case connections for these instruments cannot be removed, and extra clearance in panel cutouts must be allowed. See notes on mounting-dimensions drawing, Y19809. Gauges and thermometers in Model 530 (8") case may need wooden shims between the case bottom and the panel if the panel is over 1/2" thick. Be careful not to bend severely or pull on thermometer and seal tubing.

PART III CASE CONNECTIONS

A. General

The Model 500 and 530 cases are provided with a universal connection plate (Figure 2) which can be used for bottom or back connections and can be changed at any time.

Before making any connections to your instrument, check the voltage and frequency specified on the instrument nameplate and study the wiring diagram provided (wiring diagrams are generally not provided when the only electrical connections are for a chart drive).

B. Standard Connection Sequence

Measuring elements, chart drive, etc., are always connected in a standard sequence in Model 500 and 530 cases for gauges and thermometers. Separate diagrams are always furnished with gauges and thermometers, showing the standard connection sequence.

C. Color Coding for Multiple-pen Recorders

Each measuring system in Bristol's multiple-pen recorders is identified by a standard color code. The color for each system is listed on the instrument nameplate inside the case door. This color is painted on each pen arm, set-point index, set-point knob, case connection and also on thermometer bulbs (if used). The color of the recording ink also corresponds to the color code.

D. Air-control Connections

Case connections for supply and output air for pneumatic controllers are not made thru the universal connection plate, but at separate connections shown in the mounting dimensions for such instruments.

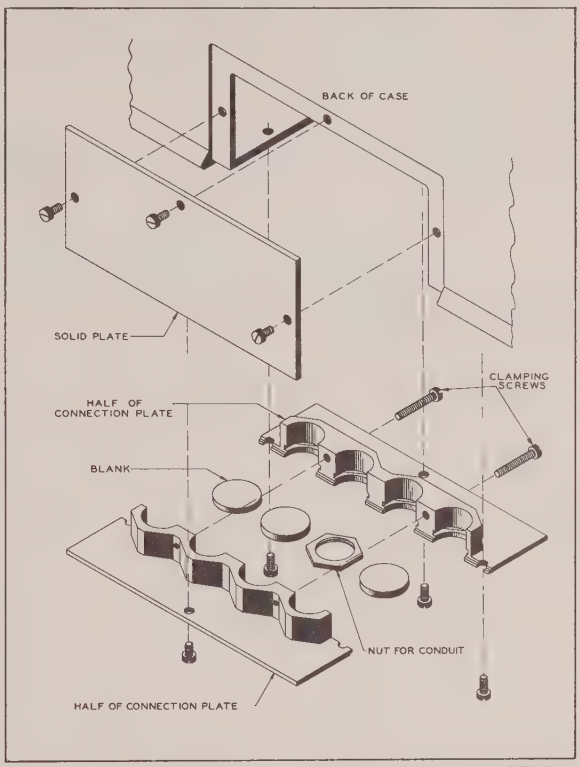

FIGURE 2. EXPLODED VIEW OF UNIVERSAL CONNECTION PLATE

E. Case-connection Fittings

A number of different fittings are available for standard conduit, pipe, electrical wiring, tubing, etc. A blank may be supplied to seal any unused connection holes.

PART IV CASE CHANGES AND SERVICE

A. General

Case-connection changes can be made without extra parts, using only a screwdriver. If different fittings are required (see paragraph D above), they may be ordered from Parts List Y19807.

All changes are made from the outside of the instrument case.

B. Changing from Back to Bottom Connected

Uncouple all inflexible connections to the connection plate, such as pipe, conduit, etc. (Do not attempt to remove thermometer tubing or other sealed systems.) Remove the solid plate from the bottom of the case by taking out the four screws holding it (a surface-mounted case will have to be removed from the surface upon which it is mounted). Then remove the three screws holding the connection plate, being careful to hold the plate so that it will not damage the tubing or other connections which cannot be removed. Do not unclamp the connection plate.

Now move the connection plate from the back to the bottom position, being careful not to damage the flexible connections. Fasten the connection plate into the bottom position and the solid plate into the back position. If you have removed a surface-mounted case, replace it on the surface. Attach any couplings, conduit, etc., that might have been removed while making the change.

C. Changing from Bottom to Back Connected

The same procedure outlined in paragraph B above is followed when changing from bottom to back connected.

D. Service and Repair

Parts List Y19807 gives a complete list of all the parts of the Model 500 and 530 cases. Order replacement and spare parts from this list.

The Bristol Company
Waterbury 20, Connecticut., U.S.A.

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INSTRUCTION NO. Y19802

OPERATION AND SERVICE OF ROUND-CHART RECORDING SYSTEM

NOTE: This instruction covers only the recording system. See separate instructions covering the measuring system, control system, etc.

A. Unpacking

1. **Standard Recorder Accessories.** Every Bristol round-chart recorder is supplied with one of each of the following items:

box of 100 charts, range and chart number as ordered.

1-ounce bottle of ink with dropper. Multiple-pen instruments get a 1-ounce bottle of different color ink for each pen supplied.

pen cleaner wire (.005" diameter) with instructions in envelope

brass chart-drive key (spring drive only)

FIGURE 1. QUICKSET CHART HUB - OPEN

2. **Shipping Devices**

a. Remove and discard the paper packing support under pen arm.

b. Remove from under chart hub the circular instruction on the operation of Quickset chart hub. Read this instruction carefully.

B. How to Change Charts

1. Push pen lifter down in order to hold pens and pointers away from chart.

2. Tip up Quickset chart hub, as shown in Figure 1, and slip off the old chart.

3. If instrument has a spring chart drive, wind chart drive by inserting brass key thru hole in chart plate.

4. Slip new chart over chart hub, under slot (18) in chart plate and under time index (3). Turn chart by hand until time index points to correct time. **Note:** Pens on multiple-pen recorders, in order

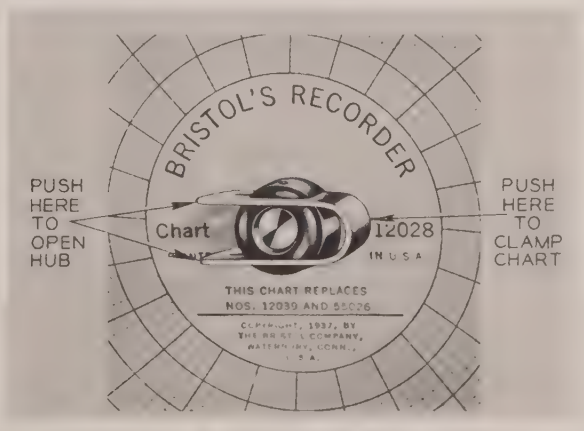


FIGURE 2. QUICKSET CHART HUB - CLOSED

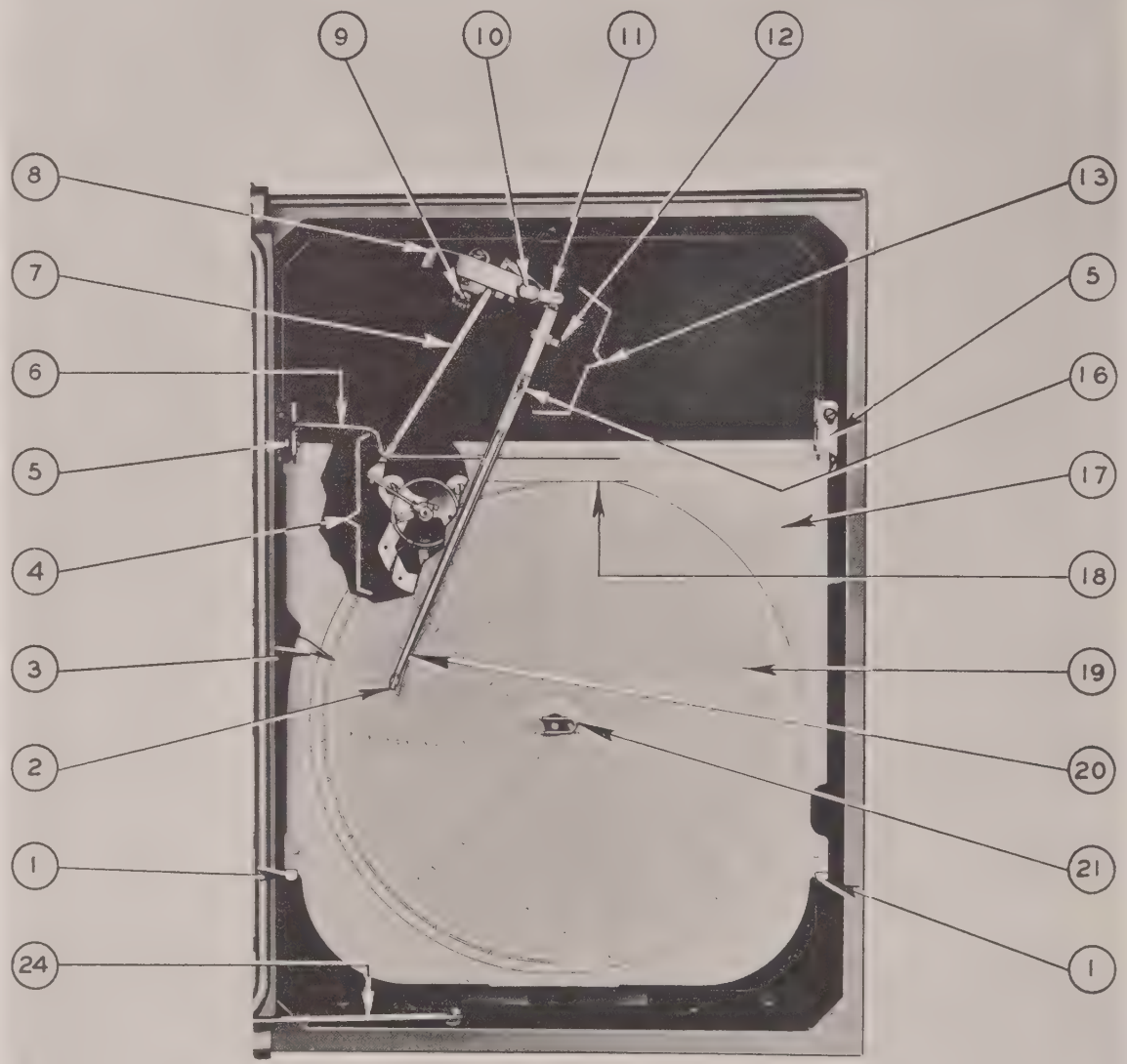


FIGURE 3. TYPICAL SERIES 500 RECORDER

to pass each other, cannot all swing on the same time arc of the chart. Therefore, the time index on such recorders is adjusted to indicate the time of the red pen, which is the only pen that follows the arc of the chart. Allowance must be made for this time difference between pens when reading charts made by multiple-pen instruments.

5. Turn chart hub down as shown in Figure 2 and push firmly on its curved end in order to hold chart. **Note:** Dairy recorder chart hubs are made with a pin which perforates the chart to prevent its being rotated by hand once it has been clamped down. Be sure to turn chart of dairy recorders to correct time at time index before pushing chart down over pin.

6. Add ink to pen or pens per paragraph C.2, page 3.

7. Lower pen or pens gently onto chart by pushing pen lifter upward.

Code To All Photos

1. Spring catch for chart plate
2. Pen
3. Time index
4. Measuring element
5. Chart plate bracket
6. Pen lifter
7. Measuring element connecting link
8. Universal pen mounting
9. Screws holding above
10. Cap screws holding tabs
11. Bearing tab
12. Micro adjustment
13. Base end of pen
14. Pen shaft lever
15. Pen shaft
16. Screws holding pen arm
17. Chart plate
18. Slot to hold top of chart
19. Recording chart
20. Pen arm
21. Quickset chart hub
23. Universal connection plate
24. Door stop
30. Speed regulator of spring chart drive
31. Start knob
32. Screws holding spring drive in case
33. Winding arbor
34. Screws holding drive cover
35. Gear change speed indicator
36. Gear change knob
37. Spring drive cover
40. Laminated core
41. Name plate of telechron motor
42. Gear train
43. Electric drive mounting plate
44. Electrical connection wires
45. Screws holding drive in case
46. Electric drive terminals
50. Shipping strap of complete motor unit
51. Motor shaft
52. Screws holding shipping strap
53. Rotor unit
54. Soldering lugs
55. Field coil
56. Location of "top" marking & rotor data
57. Rotor pinion gear
58. Screw holding motor into gear case
59. Copper shading coils

C. Pens

1. Types

a. Single-pen Recorders. Single-pen recorders are supplied with either a "V" pen or a fountain pen. Fountain pens and V pens are not interchangeable. A special fine-bore fountain pen is sometimes used for recording variables which change widely and often. If the ink record of your recorder tends to overlap and run, a fine-bore fountain pen should be obtained to replace the standard-bore fountain pen. For records of very long duration, standard-bore and fine-bore pens are available with large barrels holding 6 drops of ink. All standard- and fine-bore, 3- and 6-drop fountain pens are interchangeable.

b. Multiple-pen Recorders. Multiple-pen recorders are supplied with flattened fountain pens with capillary tips of different lengths so that they can pass each other on the chart. The pen nearest the chart is called the 1st pen, the next pen is called the 2nd pen, etc. Be careful not to bend pens (or pen arms) of multiple-pen recorders as they must pass each other without touching. Multiple-record instruments are supplied with a maximum of 2 pens on the 8" size case and 4 pens on the 12" size case.

All pens should be replaced as soon as the tip is worn, broken or corroded.

See parts list of recording accessories for complete listing of pens.

2. How to Ink and Start Pens. Pens, as supplied, usually will hold more than enough ink for one complete chart revolution. However, it is wise to refill pens every time the chart is changed.

a. V Pen. Fill V pens 2/3 full, using dropper from ink bottle supplied. If pen fails to trace when lowered on chart, touch its tip with a moistened finger.

b. Fountain Pen. Fill fountain pens to the top, using dropper from ink bottle. Standard pens take about 3 drops of ink. If pen fails to trace when lowered on chart, try touching tip of capillary tube with a moistened finger. If pen still fails to trace, pull pen off pen arm and squeeze between thumb and finger (as per Figure 4), then dip end of capillary tube in a drop of ink and release pressure of fingers. Replace pen by pushing pen all the way up on forked end of pen arm.

Use the 1-ounce bottle and pen filler furnished for re-inking pens. Buy recording ink in the economical larger size bottles and refill the 1-ounce bottles. See parts list of recording accessories for complete listing of all inks, bottles,and pen fillers.

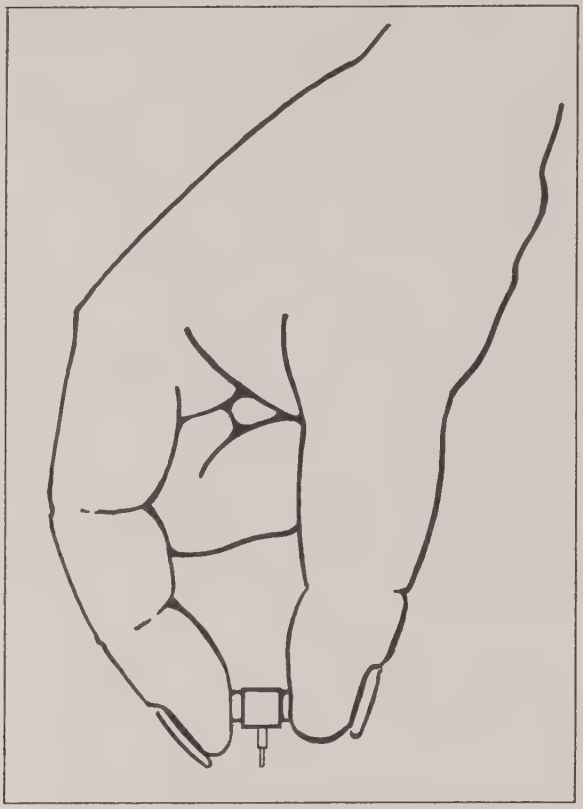


FIGURE 4. STARTING FOUNTAIN PEN TO INKING

3. How to Clean Pens. Pens should be cleaned periodically to forestall trouble because only a clean pen can trace a clean record.

To clean either a V pen or a fountain pen, loosen screw (16) holding pen arm and pull pen arm and pen off of base end (13). Wash pen in alcohol, ammonia or very hot water (if necessary, boil pen in water for a few minutes).

Clean out capillary tip of fountain pen by inserting pen cleaner wire supplied.

Replace pen arm and pen, being sure to push prongs of pen arm up under rivets on base end until it snaps into place. Retighten locking screw.

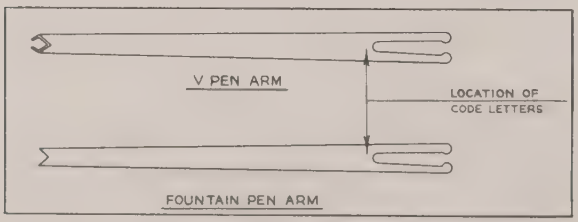


FIGURE 5. PEN ARMS

D. Pen Arms

Pen arms for V pens and for fountain pens (see Figure 5) are not interchangeable. Pen arms for 1st, 2nd, 3rd and 4th pens of multiple-pen recorders are of different lengths and, therefore, are not interchangeable.

All Bristol pen arms are identified by code letters stamped into their upper ends. Be sure to specify these code letters from your old pen arm when ordering replacements.

Do not bend pen arms. If the effective length of the pen arms is altered, the pen will not swing along the time arc on the chart and, therefore, will not record the measured variable correctly. If pen arms of multiple-pen recorders are bent, they will not pass each other freely.

E. Removing Chart Plate

The chart plate of Series 500 recorders can be removed without tools in the following manner:

Raise pen or pens by pushing down on pen lifter. Tilt up chart hub and remove chart. With thumbs of both hands, depress simultaneously 2 clips (Item 1 of Figure 3) and pull bottom of chart plate out and

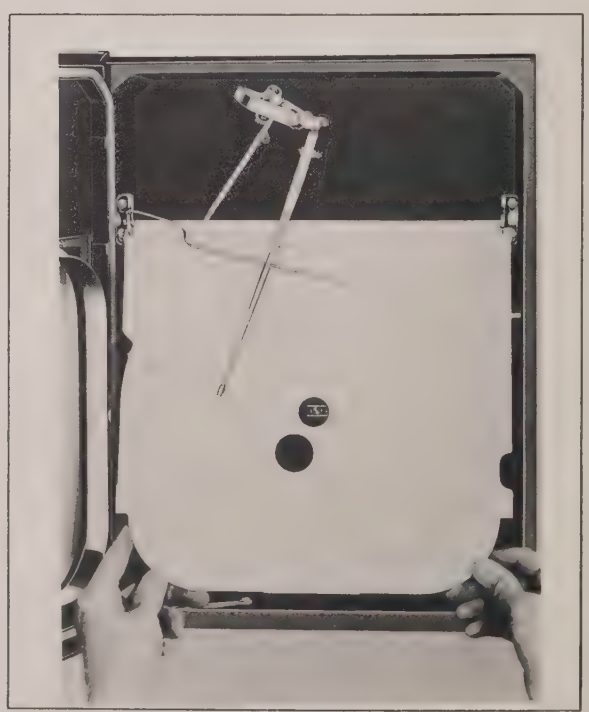


FIGURE 6. HOW TO REMOVE CHART PLATE

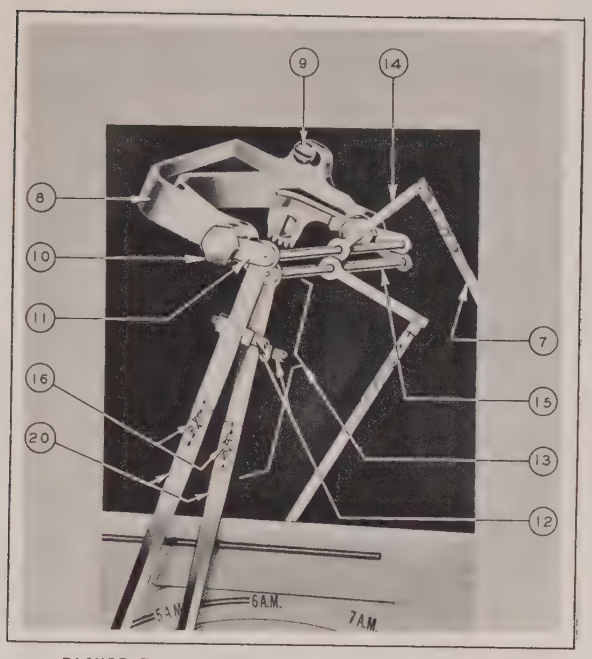


FIGURE 7. UNIVERSAL PEN MOUNTING - 2 PEN

down (see Figure 6). Chart plate may be replaced in the reverse order to above.

F. Pen Mounting and Base Ends

All Series 500 recorders are equipped with the same style universal pen mounting. Mounting parts can be easily replaced or mounting can be quickly converted to accommodate any multiple combination.

On most recorders the pen shaft (Item 15, Figure 7) can be removed by gently lifting top bearing tab (11) and slipping shaft out. Pen mounting can be disassembled by removing 2 screws (10).

Micro adjustment (12) is spring loaded to eliminate all lost motion. Its knob is both knurled and slotted for easy adjustment with fingers or a screwdriver. See measuring-system instructions for this adjustment.

A complete listing of all pen-arm mountings and parts is given in parts list for recording accessories.

G. Ink

1. Standard Color Code. The color of ink to be used in each pen of multiple-record instruments is painted on its pen arm or base end.

2. Standard Ink. Standard Bristol recorder ink will perform well at internal case temperatures from +10°F to +160°F (-23°C to +65°C).

3. Low-temperature Ink. Bristol low-temperature ink is recommended for case temperatures from -65°F to +80°F (-54°C to 26°C). It will flow evenly and will not freeze at these temperatures.

4. High-temperature Ink. Bristol high-temperature ink is recommended for case temperatures from +60°F to +500°F (+15°C to +260°C). This ink will not dry in pens or boil away when used between these temperatures.

5. Quick-Drying Ink. This type of ink is recommended with high speed charts (15-, 30- and 60-minute rotation) because it dries quickly and permits charts to be removed immediately when finished without smearing the record.

Quick-drying ink is also recommended where high humidity conditions exist.

Note: Use only Bristol recorder inks. Ordinary inks dry too fast, clogging and corroding pens. A complete listing of Bristol Company inks is given in parts list for recording accessories.

H. Chart Drives

All Bristol chart drives for round-chart recorders have identical mountings and are, therefore, interchangeable. Thus, chart rotation time or voltage and frequency used can be quickly changed. Spring and electric drives are also interchangeably mounted.

1. Service Chart Drives. All Bristol Branch and Main Factories carry stocks of carefully rebuilt, fully guaranteed spring and electric chart drives which will be exchanged for the same specification defective drive for a nominal charge. In

FIGURE 8. SPRING CHART DRIVE COMPLETE

order to positively identify correct speed, gear ratio, voltage and frequency, etc., we must receive your old chart drive before shipping the replacement service drive.

Instrument users having several Bristol recorders would do well to keep one or two, two-speed spring service chart drives in stock as universal standby replacements.

a. How to Wind. With chart removed, insert brass key thru hole in chart plate and wind arbor clockwise as far as it will turn. Wind all 7 and 8 day spring chart drives once each week. All other drives must be wound once each day.

b. Adjusting Speed. If chart revolves too fast or too slow, the speed of chart drive should be adjusted by turning adjusting lever in the direction required. Moving the lever clockwise makes the drive go faster and moving the lever counterclockwise makes the drive go slower. Cap (item 31, fig. 8) must be removed to get at adjusting lever.

c. Two-speed Drives. Some spring chart drives are equipped with a gear changer to produce two different chart rotations, for example: 24 hour and 7 day. To change from one rotation to the other, turn knob (Item 36, Figure 8) in a direction to show the desired rotation time.

d. Lubrication. Under normal conditions a spring chart drive should be cleaned and oiled about once a year. Where severe conditions exist, more frequent cleaning and oiling will be required. Only an experienced clock worker with proper equipment should be allowed to completely service a chart drive. Unless such are available, we recommend that chart drives be returned to The Bristol Company for exchange. (See "Service Chart Drives" paragraph H.1.)

For servicing spring chart drives, proceed as follows:

1st. Remove 3 mounting screws (32) and take complete chart drive out of instrument case.

2nd. Remove chart hub by loosening its setscrew with a small screwdriver.

3rd. Remove 4 nuts (34) and pull off cover.

4th. Disassemble movement and soak all parts **except** main spring assembly in benzine. Shake off excess benzine and allow all parts to dry thoroughly.

5th. Oil the main spring liberally with Bristol clock oil, Part No. A3885.

6th. Reassemble movement completely.

7th. Apply a small amount of Bristol clock oil to each bearing with a toothpick. For internal case temperatures from -20°F to +120°F use Bristol Part No. A3885 oil.

8th. Replace chart-drive cover, being careful to correctly position start lever and gear-shift knob. Replace chart hub and remount drive in recorder case.

3. Electric Chart Drives. Electric chart drives are powered by a 2-watt, self-starting synchronous motor which depends for its timing on the frequency of the alternating-current supply. Therefore, the frequency must be exactly as listed on name plate to obtain accurate chart timing. Where frequency is unregulated, we recommend use of spring chart drives.

Most recorders require power-supply wires to be connected directly to the terminal block on the chart drive.

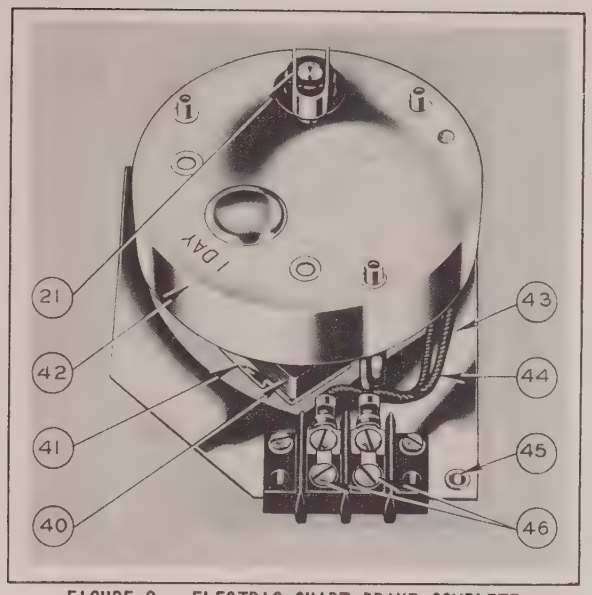


FIGURE 9. ELECTRIC CHART DRIVE COMPLETE

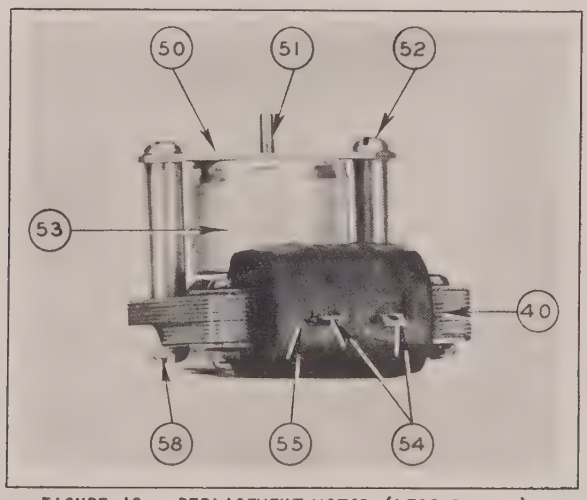


FIGURE 10. REPLACEMENT MOTOR (LESS PINION)

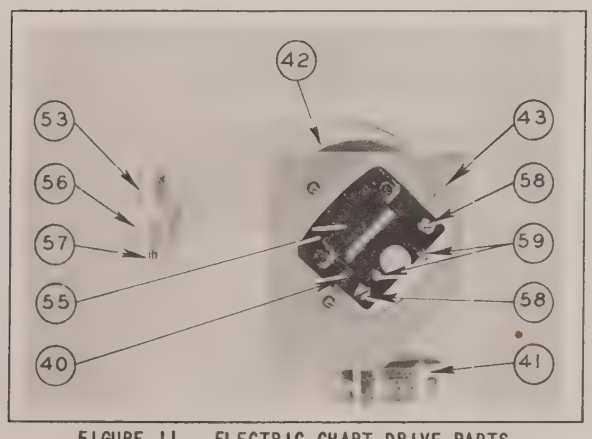


FIGURE 11. ELECTRIC CHART DRIVE PARTS

Caution: Before connecting power supply to chart drive, be sure to check on chart-drive base plate for correct voltage and frequency.

A supply-voltage variation of plus or minus 10% or less will not affect accuracy of timing.

There is no starting knob or speed regulator on electric chart drives. Electric chart drives will restart automatically after power failure, but the lost time must be made up by manually advancing the chart to correct time.

The Bristol Company can supply a reactor for installation in the chart-drive supply circuit to permit a 120-volt chart drive to operate on a 240-volt supply. This is especially convenient for portable test recorders, which can thus be operated from either 120- or 240-volt supply lines.

a. Replacement of Parts. Electric-chart-drive parts are supplied in three arrangements:

1. Complete drive as in Figure 9.
2. Motor unit complete as in Figure 10.
3. Rotor and pinion only shown in Figure 11. (Items 53, 56 & 57).

See parts list for complete chart-drive listing. As a rule either the motor complete or the rotor only need be replaced because of wear. Motor complete is furnished with shipping plate and screws to hold it together during shipment. These should be removed and discarded when motor unit is put into use.

By changing motor units and/or rotor units, any electric chart drive can be rebuilt to produce any standard combination of voltage and frequency. In ordering replacement parts, specify all data on the motor name plate. In ordering rotors, specify all data stamped on its barrel. Direction of rotation can be reversed by turning over the laminated magnet and field coil assembly (Items 40 and 55).

b. Disassembly of Chart Drive. Turn off power supply and disconnect leads from terminals. Unscrew 3 screws (45) and remove complete chart drive from

instrument case. Turn chart drive upside down and remove 2 screws (58) which permits rotor and motor to be removed from gear train. Note carefully position of the 2 copper shading coils (59) on laminated core before disassembly.

Replace rotor, motor, etc., as required and reassemble. Be sure to replace laminated magnet with copper shading coils (59) in same position as before. The direction of rotation of the rotor and consequently that of the chart can be reversed by turning magnet over and installing it with shading coils in the reverse position.

Note that the rotor has the word "top" stamped into edge of barrel. In assembling, turn rotor so "top" will be uppermost when chart drive is mounted in the instrument case to assure proper lubrication.

Replace chart drive in case and reconnect to power supply.

c. Lubrication. Rotor unit never requires lubrication. After 2 or 3 years use, the gear train only (motor and rotor removed) should be cleaned with benzine, allowed to dry and then oiled with Bristol clock oil Part No. A3885.

4. Combination Electric and Spring Chart Drives. When starting up for the first time or after prolonged shutdown, be sure to wind the spring in duplex chart drives. The spring drive will operate for an aggregate of 24 hours at one winding. When the spring is run down, a red signal (or indicator) will appear in a hole in the outer casing of the chart drive.

The combination electric and spring chart drive is wired in the same manner as the standard electric drive referred to in paragraph 3, page 6. If the electricity should fail, the spring drive unit starts immediately. The chart drive is fast acting in the change-over from electric to emergency operation and vice versa. A hairpin clutch and magnets hold the balance wheel at peak tension while the electric drive is in operation.

J. Repairs, Correspondence and Shipping

Address all correspondence and orders to the nearest Branch Office.

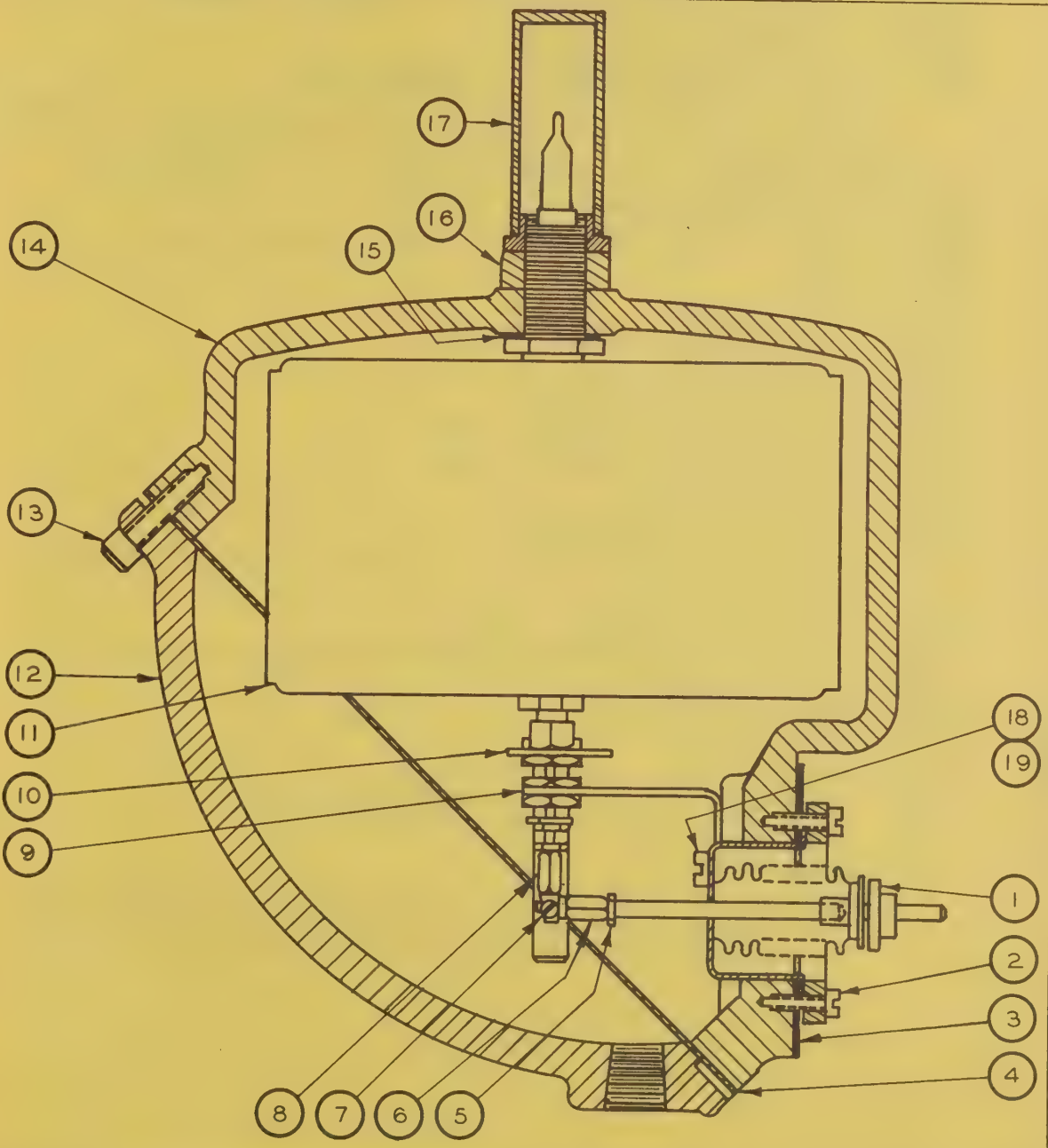
Ship all parts for repair or exchange only to Bristol Branch or Main Factory, never to Branch Offices. Identify all shipments fully, including your exact return address and repair order number. Be sure to state model and serial number of instrument in all orders and correspondence.

Addresses and phone numbers of Bristol Field Organization are listed on the last page of all instruction books.

The Bristol Company
Waterbury 20, Conn., U.S.A.

Printed in U.S.A.

ABSOLUTE PRESSURE GAUGE ELEMENT
(1957 DESIGN)



BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	PART NO.	DESCRIPTION
		COMPLETE ELEMENT HOUSING
	A3776	Brass trim, aluminum housing
	A3777	Gold plated trim and housing
	A3778	Nickel plated trim and housing
	A3779	Silver plated trim and housing
	A3780	Stainless steel trim and housing
	A3781	Stainless steel trim and aluminum housing
		NOTE: When ordering any of above part numbers, it is necessary to specify range desired in order to get proper diaphram element.
1	B2128	Lever bearing complete (Brass)*
	B2125	Lever bearing complete (Stainless Steel)
2	98278	#6-40 x 7/16" Socket-head cap screw (Steel)
	86322	#6-40 x 1/2" Socket-head cap screw (Steel, used on S.S. Housing)
3	97560	Gasket
4	97559	Gasket
5	31384	Hex nut (Brass)*
	98258	Hex nut (Stainless Steel)
6	A5411	Connector (Brass)*
	98257	Connector (Stainless Steel)
7	83596	#0-80 Shoulder screw (Brass)*
	98252	#0-80 Shoulder screw (Stainless Steel)
8	A5410	Over travel plunger (Brass)*
	A5376	Over travel plunger (Stainless Steel)
9	A5406	Stop bracket (Steel)*
	A5377	Stop bracket (Stainless Steel)
10	A5404	Partial-Range stop (if required)
11		Capsular element (Specify model, serial number and range of instrument)
12	97551	Cover (Aluminum)*
	97595	Cover (Stainless Steel)
13	89661	1/4 - 20 x 5/8" Socket-head screw (Steel)
	98279	1/4 - 28 x 5/8" Socket-head screw (Steel, used on S.S. Housing)
14	97550	Housing (Aluminum)*
	97594	Housing (Stainless Steel)
15	98263	Gasket
16	12887	1/2 - 27 Hex nut
17	87115	Cap
18	67029	#10-32 x 5/16" Fillister-head screw (Brass)*
	A3886	#10-32 x 5/16" Fillister-head screw (Stainless Steel)
19	29414	Washer (Steel)
	A5378	Washer (Stainless Steel)

*NOTE All parts with an asterisk may be ordered plated with either gold, silver or nickel as required. When ordering a plated part, specify part number of desired part, description and the kind of plating desired.

PARTS LIST Y19807

ISSUE OF OCTOBER 1963

SERIES "500" 8" & 12" CASES

STANDARD & PORTABLE

RECORDERS — INDICATORS — ACCESSORIES

- CONTENTS -

	PAGE NUMBER
BASIC RECORDER	2, 3 & 4
BASIC PORTABLE RECORDER	2, 3 & 4
BASIC DIAL TYPE INDICATOR	2, 3 & 4
PEN ARMS	5
PENS	5
PEN MOUNTINGS	6 & 7
CAPILLARY INKING SYSTEMS	8 & 9
INK	10
SPRING CHART DRIVES	11
ELECTRIC CHART DRIVES	12

Be sure to state model and serial number of instrument when ordering parts.

THE BRISTOL COMPANY WATERBURY 20, CONNECTICUT

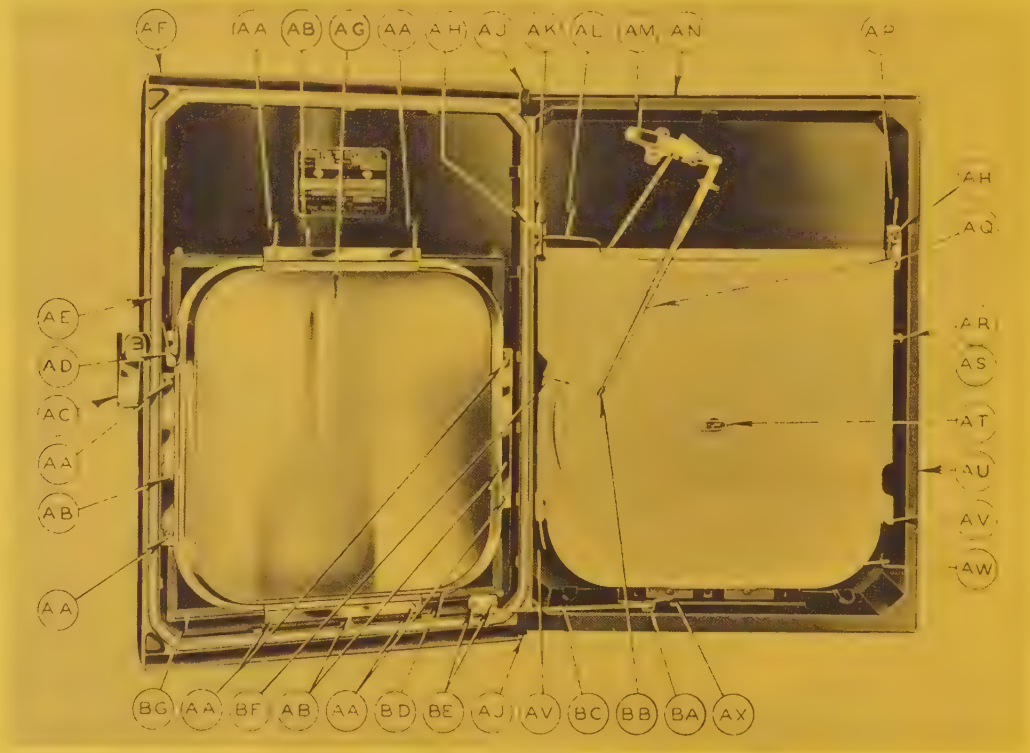


FIGURE 1. SERIES "500" RECORDER

FIGURE 2. SERIES "500" PORTABLE RECORDER

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

FIGURE 3. SERIES "500" INDICATOR

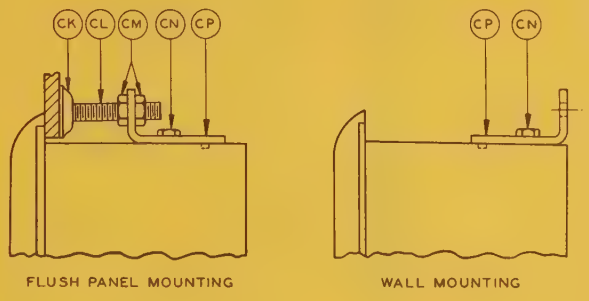


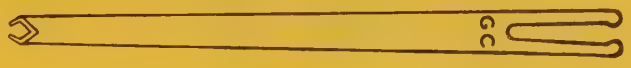
FIGURE 4. UNIVERSAL MOUNTING BRACKET

ITEM	PART NUMBER	DESCRIPTION
		NOTE: Case sizes are determined by the nominal chart or dial dimensions: 8" and 12"
AA	82656	6 x 1/4" Self tapping screw
AB	82663	Glass clips, sides and bottom for 8" case
	82637	Glass clips, sides and bottom for 12" case
	89261	Glass clips, top for 8" case
	89262	Glass clips, top for 12" case
AC	82616	Door handle without lock
	82615	Door handle with lock
NOT SHOWN	94738	Latch plate, used with part no. 82615
NOT SHOWN	82630	Flat spring, used with item AC
NOT SHOWN	84726	Key for door lock
AD	88751	Hook complete, including setscrew
	82415	10-32 x 1/4" Bristo cone-point setscrew for item AD
AE	82608	Door gasket; order 45" for 8" case or 62" for 12" case
AF		Case cover; order by model and serial number of instrument
AG	82662	Glass for door of 8" case
	82643	Glass for door of 12" case
	86515	Blank for door of 8" portable case
	86809	Blank for door of 12" portable case
AH	85812	10 x 5/16" Screw
AJ	82654	Hinge-pin bracket
NOT SHOWN	92694	10-32 x 1/2" Fillister-head screw for item AJ
NOT SHOWN	10075	Washer for above screw
AK	82650	Left-hand, chart-plate bracket
AL	90146	Pen lifter for 8" case
	82648	Pen lifter for 12" case
	90147	Pen lifter bracket for 8" case
NOT SHOWN	84103	Pen lifter bracket for 12" case
NOT SHOWN	86804	6-40 x 1/4" Screw for mounting above bracket
	43040	Washer for above screw
AM		Pen mounting, (see pages 6 and 7)
NOT SHOWN	66541	10-32 x 1/2" Screw for mounting item AM
NOT SHOWN	10075	Washer for above screw
AN		Case body; Order by model and serial number of instrument
AP	82651	Right-hand chart-plate bracket
AQ		Pen arm (see Figure 5)
AR	71283	Roller for door hook
AS	82638	Roller pin
AT	74986	Chart hub (standard)
	86771	Chart hub for dairy recorders
AU		Case complete; order by model and serial number of instrument
AV	82633	Spring catch for chart plate

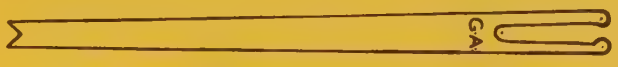
BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	PART NUMBER	DESCRIPTION
NOT SHOWN	82634	6-40 Screw for mounting item AV
	20903	6-40 Nut for above screw
AW	84727	Standard chart plate for 8" case
	84728	Standard chart plate for 12" case
	87674	Chart plate for 12" integrating flowmeter
AX	87392	Door-stop screw
BA	44739	Collar for door-stop screw
BB		Pen (see Figure 6)
BC	86520	Door stop complete for 8" case
	86522	Door stop complete for 12" case
BD	82657	Aluminum shield for 8" case
	82642	Aluminum shield for 12" case
	82659	Aluminum shield for 534 case
BE	40066	8-32 x 1/4" Fillister-head screw
	18372	8-36 x 1/4" Fillister-head screw for 534 case
BF	84724	Time index
NOT SHOWN	67694	2-64 x 3/16" Screw for mounting item BF
	87118	2-64 Hexagon nut for above screw
BG	84725	Gasket, under glass or metal blank. 34" for 8" case, 43" for 12" case
BH	38288	Bottle clip (2 used on 2-pen instrument)
NOT SHOWN	39425	10-32 x 1/4" Screw for above clip (item BH)
	86545	10 x 3/16" Self-tapping screw (used on early models)
BJ	86526	Mounting plate to hold bottle and key clips
NOT SHOWN	86298	Mounting plate stud for item BJ
	13775	Nut for above stud
BK	70628	1/4 oz. ink bottle (2 used on 2-pen instrument)
BL	86546	Bottle cap and dropper
BM	84450	Chart-drive key
BN	86527	Spring clip for chart-drive key
NOT SHOWN	18339	6-40 x 1/4" Screw for above clip (item BN)
	83999	6 x 3/16" Self tapping screw (used on early models)
BP	83051	Handle
NOT SHOWN	66541	10-32 x 1/2" Fillister-head screw for mounting handle (item BP)
	20843	Washer for above screw
BQ	89650	1/4"-20 x 1/4" Set screw
BR	67029	10-32 x 5/16" Fillister-head screw
BS	83053	Foot complete (includes items BT and BU)
	83050	Foot (casting only, drilled, tapped and finished)
NOT SHOWN	38451	1/4"-20 x 1/2" Fillister-head screw for mounting foot (item BS)
	39714	Washer for above screw
BT	82626	Leveling-screw knob
BU	82625	Leveling screw
BV	86514	Clip for extra charts (8" Case)
	86753	Chart clip for 12" case
BW	82653	Connection-mounting plate (solid)
BX	66546	10-32 x 1" Fillister-head screw
CA	82664	Blank Plug
NOT SHOWN	84729	Hexagon nut for 1/2" conduit connection
	84681	Rubber grommet for electrical connection
CB	86794	Mounting plate for multiplier unit
CC	72791	Pointer for 8" case
	72908	Pointer for 12" case
NOT SHOWN	87345	Zero stop bracket
	87909	Outer dial plate blank for 12" recorders
	87908	Inner dial plate blank for 12" recorders
	87346	Dial plate blank for 8" recorders
CD	86795	Lever arm for multiplier unit
CE	76885	Multiplier unit for gauges and metameters
	71305	Multiplier unit for thermometers and flowmeters
NOT SHOWN	86791	Post for mounting multiplier unit (item CE)
CF		Linkage to measuring element; order by model and serial number of instrument
CG	83106	Post for dial plate
CH	82674	Connection mounting plate (top half)
CJ	83998	Connection mounting plate (bottom half)
CK	92031	Cup washer
CL	83848	Screw
CM	50706	Nut
CN	32193	Screw
CP	92030	Mounting bracket

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS



V-PEN ARM



FOUNTAIN-PEN ARM

FIGURE 5. SERIES "500" PEN ARMS

DESCRIPTION	PART NO.
Pen arm marked:	
FA	84348
FB	84349
FC	84350
FD	84351
FE	83728
FG	90651
FH	90650
FJ	93188
FK	93189
FL	94014
GA	83725
GB	83727
GC	83724
GJ	94073
GK	94074

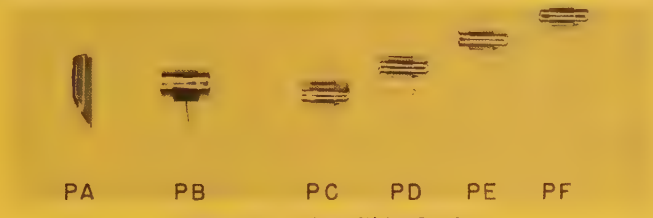


FIGURE 6. FOUNTAIN PENS

ITEM	PART NUMBER	DESCRIPTION
PA	42648	V-pen for single pen or 2-pen divided chart instrument
	42650	V-pen with closed back for 2-pen instrument
	42649	V-pen with open back for 2-pen instrument
PB		Fountain pen for 1-pen instruments (except free-vane controllers) and 2-pen divided chart instruments. 3-drop pens are standard, but 6-drop pens may be used in flowmeters, ammeters, voltmeters and all metameter receivers.
	30425	Standard bore 3-drop pen
	46108	Fine bore 3-drop pen
	42909	Standard bore 6-drop pen
	82499	Fine bore 6-drop pen
PC	32914	Pen for 1-pen free-vane controller or nearest chart in multiple pen instrument
PD	32915	Pen, second from chart in multiple pen instrument
PE	32916	Pen, third from chart in multiple pen instrument
PF	28577	Pen, fourth from chart in multiple pen instrument
NOT SHOWN	32900	Pen cleaning wire

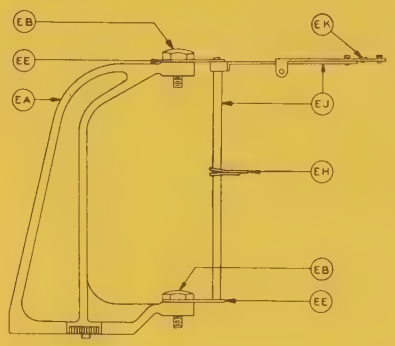


FIGURE 7

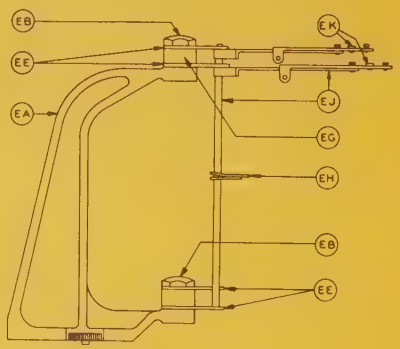


FIGURE 8A

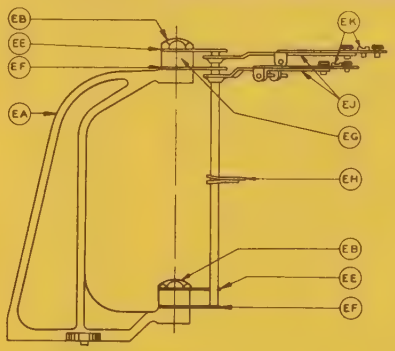


FIGURE 8B

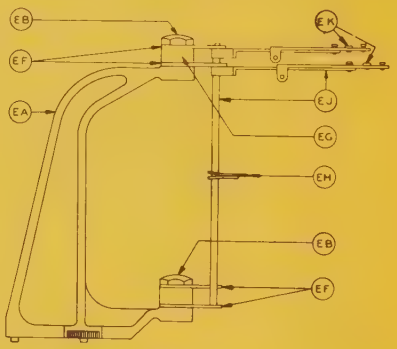


FIGURE 8C

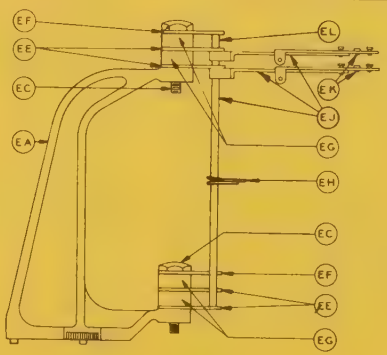


FIGURE 8D

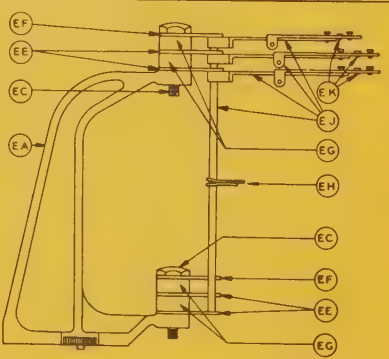


FIGURE 9A

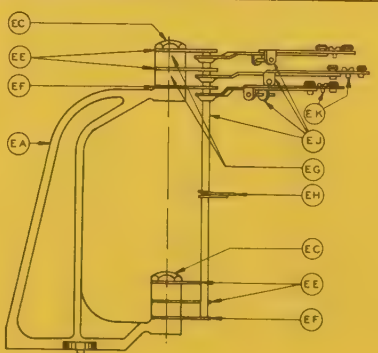


FIGURE 9B

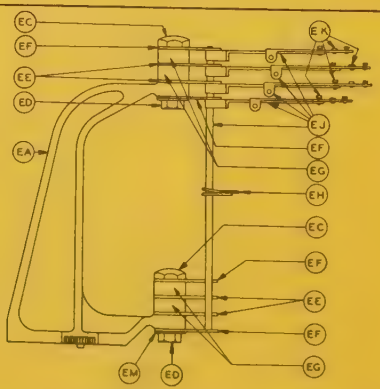
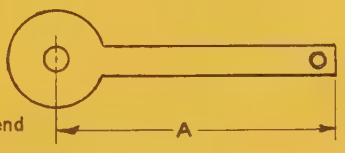


FIGURE 10

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	PART NUMBER	DESCRIPTION
FIGURE 7	84703	Standard single-pen-mounting complete, for 8" or 12" cases
	89974	Metavane transmitter complete, for 8" case only
FIGURE 8A	84704	Standard 2-pen mounting complete, for 8" or 12" cases
	86415	1-pen, 1-control unit, free-vane controller pen mounting complete, for 12" case only
FIGURE 8B	91695	2-pen mounting complete, for flowmeter with pressure pen for 8" or 12" cases
FIGURE 8C	91292	8" Indicating free-vane controller pen mounting complete
	88277	12" Indicating free-vane controller pen mounting complete
FIGURE 8D	88291	12" Autoset free-vane controller pen mounting complete
FIGURE 9A	84705	Standard 3-pen mounting complete, for 12" case
	86430	2-pen, 1-control unit, free-vane controller pen mounting complete, for 12" case
FIGURE 9B	91696	Flowmeter with pressure and temperature, 3-pen mounting complete for 12" case
FIGURE 10	84706	Standard 4-pen mounting complete, for 12" case only
	86432	2-pen, 2-control unit, free-vane controller pen mounting complete for 12" case
EA	84701	Standard pen arm mounting
	86412	Pen arm mounting for free-vane controller
EB	84170	6-40 x 7/16" Screw
EC	84171	6-40 x 15/16" Screw
ED	20903	6-40 Hexagon nut
EE	84272	Short tab (item EF used on metavane transmitter)
EF	84271	Long tab
EG	84172	Spacer
EH	84110	Straight lever arm with six holes
		Straight lever arm with one hole at outer end
	89972	Dimension A = 15/16"
	88280	Dimension A = 1"
	91291	Dimension A = 1 1/16"
	86433	Dimension A = 1 5/16"
	86486	Dimension A = 1 9/16"
		Straight lever arm with one tapped hole at outer end
	88278	Dimension A = 1 1/16"
	91289	Dimension A = 1 1/8"
	86435	Dimension A = 1 13/32"
	86414	Dimension A = 1 3/4"
	83734	Offset lever arm with four holes
	86437	Offset lever arm with one tapped hole
EJ	84270	Base end and shaft complete
	90809	Base end and shaft complete, for metavane transmitter
EK	82591	1-72 x 3/32" Special-head screw (included in item EJ)
EL	84107	Shaft for autoset unit
EM	87148	Washer



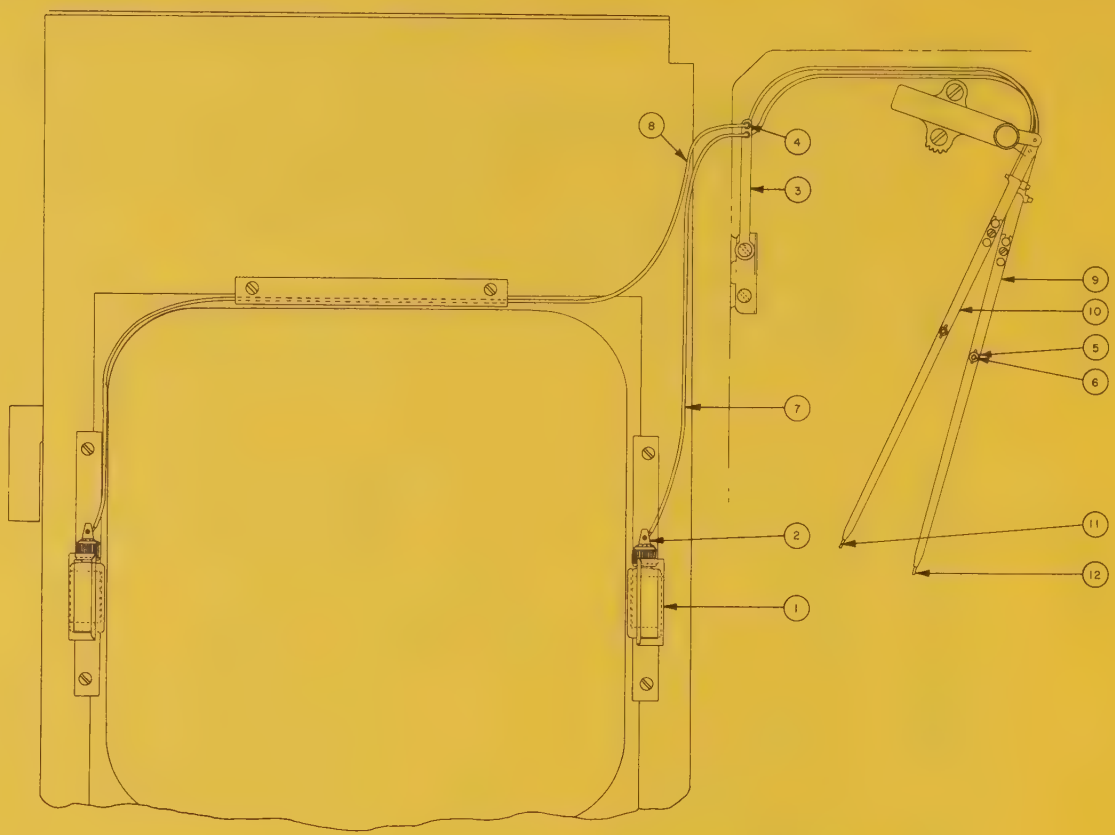


FIGURE 11. CAPILLARY PEN SYSTEM FOR ONE AND TWO PEN RECORDERS.

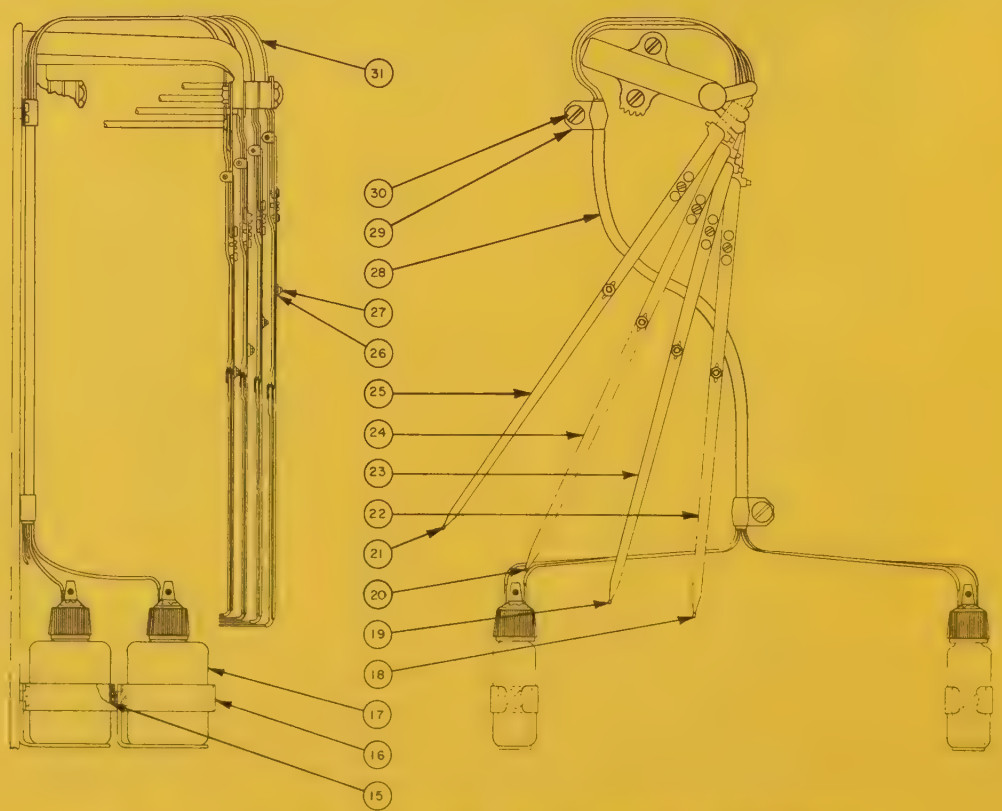


FIGURE 12. CAPILLARY PEN SYSTEMS FOR THREE & FOUR PEN RECORDERS.

CAPILLARY INKING SYSTEMS

ITEM	PART NO.	DESCRIPTION
1	A8880	Clip
2	A8889	Bottle assembly
3	A8883	Tube support
4	A8884	Sleeve
5	36647	Washer
6	A8878	Special hex nut
		Used on all capillary inking system except 3 & 4 pen
		ATTACHMENT Z35A - Capillary inking system for 1 pen, 8", series 530 Recorder. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A8848	Feed tube (21 1/2" long)
9	A8885	Pen arm
12	A9697	Pen assembly
		ATTACHMENT Z35B - Capillary inking system for 2-pen, 8", series 530 Recorder. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A8848	Feed tube (21 1/2" long)
8	A8848	Feed tube (27 1/2" long)
9	A8885	Pen arm (red)
10	A8886	Pen arm (blue)
11	A9699	Pen assembly (blue)
12	A9697	Pen assembly (red)
		ATTACHMENT Z37 - Capillary inking system for 1-pen, 12", series 532 Air Control. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A10129	Feed tube (21 1/2" long)
9	A8882	Pen arm
12	A9698	Pen assembly
		ATTACHMENT Z37A - Capillary inking system for 1-pen, 12", series 500 Air Control. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A10129	Feed tube (21 1/2" long)
10	B2497	Pen arm (red)
11	A9695	Pen assembly
		ATTACHMENT Z37B - Capillary inking system for 2-pen, 12", series 500 Air Control. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A8848	Feed tube (21 1/2" long).
8	A8848	Feed tube (31 1/2" long)
9	B2497	Pen arm (red)
10	B2498	Pen arm (blue)
11	A9695	Pen assembly (blue)
12	A9696	Pen assembly (red)
		ATTACHMENT Z38A - Capillary inking system for 1-pen, 12", series 500 Recorder. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A10129	Feed tube (24" long)
9	B2403	Pen arm
12	A9694	Pen assembly
		ATTACHMENT Z38B - Capillary inking system for 2-pen, 12", series 500 Recorder. (Includes items 1 thru 6 above plus the following) (Refer to Figure 11).
7	A10129	Feed tube (24" long)
8	A10129	Feed tube (35" long)
9	B2403	Pen arm (red)
10	B2497	Pen arm (blue)
11	B9695	Pen assembly (blue)
12	B9694	Pen assembly (red)
		ATTACHMENT Z38C - Capillary inking system for 3-pen, 12", series 500 Recorder. (Refer to Figure 12).
15	A6180	Special nut
16	A6362	Bracket
17	A6356	Bottle
19	A9694	Pen assembly (red)
20	A9695	Pen assembly (blue)
21	A9696	Pen assembly (black)
23	B2403	Pen arm (red)
24	B2497	Pen arm (blue)
25	B2498	Pen arm (black)
26	A8878	Special hex nut
27	36647	Washer
28	A6179	Guide tube
29	39425	#10-32 x 1/4" Special Fillister-head screw
30	95379	Clamp
31	A10129	Feed tube, (90", makes three tubes)
		ATTACHMENT Z38D - Capillary inking system for 4-pen, 12", series 500 Recorder. (Refer to Figure 12).
15	A6180	Special nut
16	A6362	Bracket
17	A6356	Bottle
18	A9690	Pen assembly (purple)
19	A9691	Pen assembly (red)
20	A9692	Pen assembly (blue)
21	A9693	Pen assembly (black)
22	B2726	Pen arm (purple)
23	B2403	Pen arm (red)
24	B2497	Pen arm (blue)
25	B2498	Pen arm (black)
26	A8878	Special hex nut
27	36647	Washer
28	A6179	Guide tube
29	39425	Special Fillister-head screw
30	95379	Clamp
31	A10129	Feed tube (120", makes four tubes)

STANDARD INK

BOTTLE SIZE	TEMPERATURE RANGE +10°F TO +160°F					
	RED	BLUE	GREEN	BLACK	PURPLE	ORANGE
1 oz. (with dropper)	6883	19084	28134	31673	26475	A8229
2 oz.	40024	47971	40025	40026	40028	
4 oz.	47975	47976	47977	47979	47978	98338
1/2 pint	47980	47981	47982	47984	47983	
1 pint	47985	47986	47987	47989	47988	
1 quart	47990	47991	47992	47994	47993	
1 gallon	65500	65501	65502	65504	65503	

LOW TEMPERATURE INK

BOTTLE SIZE	TEMPERATURE RANGE -65°F TO +80°F			
	RED	BLUE	GREEN	PURPLE
1 oz. (with dropper)	85601	85613	85607	A9604
4 oz.	85602	85614	85608	A9605
1/2 pint	85603	85615	85609	A9606
1 pint	85604	85616	85610	A9607
1 quart	85605	85617	85611	A9608
1 gallon	85606	85618	85612	A9609

HIGH TEMPERATURE INK

BOTTLE SIZE	TEMPERATURE RANGE +60°F TO +500°F			
	RED	BLUE	GREEN	BLACK
1 oz.	83429			A8231
4 oz.	83430		A8225	
1/2 pint	83431			
1 pint	83432	A8695		
1 quart	83433			
1 gallon	83434			

QUICK DRYING INK

BOTTLE SIZE	TEMPERATURE RANGE +32°F TO +125°F					
	RED	BLUE	GREEN	PURPLE	BLACK	ORANGE
1 oz.	88950	88951	A3868	A3869		A8230
2 oz.	71234	A8227				
4 oz.	88952	88953	A8222		A8223	A8224
1/2 pint	88954	88955				
1 pint	88956	88957	A8693	A8694		
1 quart	88958	88959				

HIGH HUMIDITY INK

BOTTLE SIZE	TEMP. RANGE +35°F TO +125°F		
	RED	BLUE	BROWN
1 oz.	A3697	A6222	
2 oz.	A2572		A3499

ALL PURPOSE INK

BOTTLE SIZE	TEMP. RANGE -35°F TO +150°F		
	RED	BLUE	
1 oz.	A10055	A10060	
1 pint	A10056	A10061	
1 quart	A10057	A10062	
1 gallon	A10058	A10063	

FIGURE 13. SPRING CHART DRIVE.

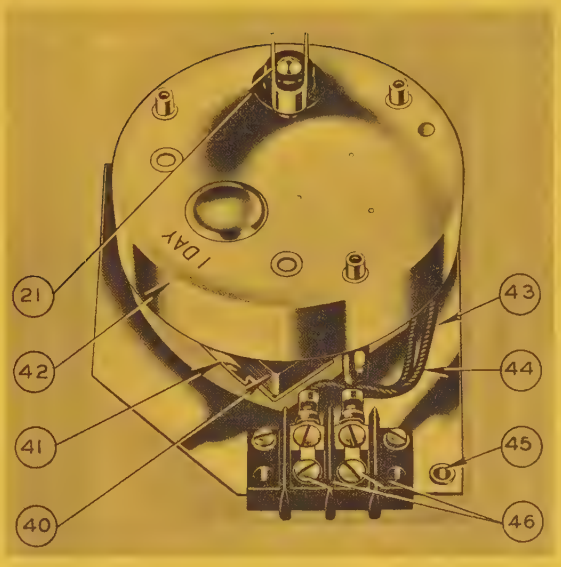


FIGURE 14. ELECTRIC CHART DRIVE

SPRING CHART DRIVES

DESCRIPTION	PART NO.
STANDARD SPRING DRIVEN CHART DRIVES:	
SINGLE SPEED	
12 hour, 30 hour wind	A6779
24 hour, 30 hour wind	90688
24 hour, 8 day wind	A6778
48 hour, 8 day wind	A6780
7 day, 8 day wind	A6781
8 day, 8 day wind	A6782
TWO SPEED	
96 minute or 24 hour, 30 hour wind	A6786
2 hour or 8 hour, 30 hour wind	A6785
24 hour or 3 day, 8 day wind	A6784
24 hour or 7 day, 8 day wind	98125
24 hour or 8 day, 8 day wind	A7196
48 hour or 7 day, 8 day wind	A6783
JEWELED SPRING DRIVEN CHART DRIVES:	
SINGLE SPEED	
12 hour, 30 hour wind	A6990
24 hour, 30 hour wind	A6988
24 hour, 8 day wind	A6989
48 hour, 8 day wind	A6991
7 day, 8 day wind	A6992
8 day, 8 day wind	A6993
TWO SPEED	
96 minutes or 24 hour, 30 hour wind	A6998
2 hour or 8 hour, 30 hour wind	A6997
24 hour or 3 day, 8 day wind	A6996
24 hour or 7 day, 8 day wind	A6994
24 hour or 8 day, 8 day wind	A7197
48 hour or 7 day, 8 day wind	A6995
OVEN TEMPERATURE RECORDER SPRING DRIVEN CHART DRIVES:	
1 hour or 3 hour, 8 hour wind	A6901
2 hour or 8 hour, 8 hour wind	A6900
CHART DRIVE OIL	
1 oz. bottle (for temperatures -20°F to +120°F)	A3885
2 oz. bottle (for temperatures +100°F to +400°F)	95750

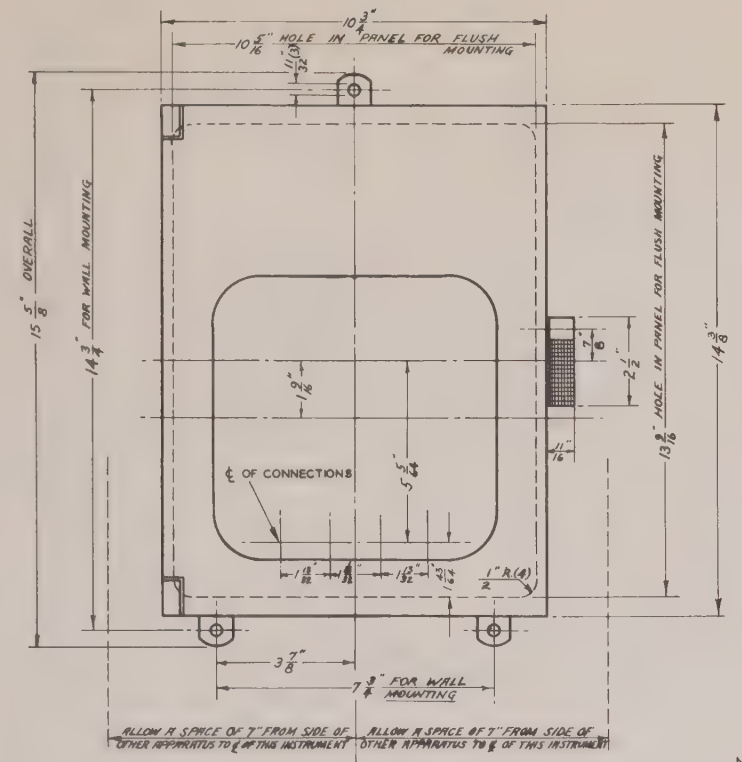
ELECTRIC, SINGLE-SPEED CHART DRIVES:

SPINDLE SPEED	VOLTAGE & FREQUENCY	PART NO. COMPLETE	MOTOR ONLY	ROTOR & PINION	FIELD COIL
30 Min.	120 V. 60 C.	86212	SEE NOTE 1	83033	
96 Min.	120 V. 60 C.	87352	86562	83032	45621
	120 V. 50 C.	87353	SEE NOTE 2	83473	45618
	120 V. 25 C.	87354	86563	83474	45609
	240 V. 60 C.	87355	86560	83032	45622
	240 V. 50 C.	87356	86561	83473	
	240 V. 25 C.	87357	87350	83474	45610
4 Hr.	120 V. 60 C.	89757	86562	83032	45621
	120 V. 50 C.	89758	SEE NOTE 2	83473	45618
	120 V. 25 C.	89759	86563	83474	45609
	240 V. 60 C.	89760	86560	83032	45622
	240 V. 50 C.	89761	86561	83473	
	240 V. 25 C.	89762	87350	83474	45610
8 Hr.	120 V. 60 C.	86218	86562	83032	45621
	120 V. 50 C.	86854	SEE NOTE 2	83473	45618
	120 V. 25 C.	86855	86563	83474	45609
	240 V. 60 C.	86856	86560	83032	45622
	240 V. 50 C.	86857	86561	83473	
	240 V. 25 C.	86858	87350	83474	45610
12 Hr.	120 V. 60 C.	86220	86562	83032	45621
	120 C. 50 C.	86858	SEE NOTE 2	83473	45618
	120 V. 25 C.	86859	86563	83474	45609
	240 V. 60 C.	86860	86560	83032	45622
	240 V. 50 C.	86861	86561	83473	
	240 V. 25 C.	87359	87350	83474	45610
24 Hr.	120 V. 60 C.	86221	86562	83032	45621
	120 V. 50 C.	86222	SEE NOTE 2	83473	45618
	120 V. 25 C.	86223	86563	83474	45609
	240 V. 60 C.	86862	86560	83032	45622
	240 V. 50 C.	86863	86561	83473	
	240 V. 25 C.	87360	87350	83474	45610
48 Hr.	120 V. 60 C.	86224	86562	83032	45621
	120 V. 50 C.	86864	SEE NOTE 2	83473	45618
	120 V. 25 C.	86865	86563	83474	45609
	240 V. 60 C.	86866	86560	83032	45622
	240 V. 50 C.	86867	86561	83473	
	240 V. 25 C.	87361	87350	83474	45610
72 Hr.	120 V. 60 C.	86225	86562	83032	45621
	120 V. 50 C.	86868	SEE NOTE 2	83473	45618
	120 V. 25 C.	86869	86563	83474	45609
	240 V. 60 C.	86870	86560	83032	45622
	240 V. 50 C.	86871	86561	83473	
	240 V. 25 C.	87362	87350	83474	45610
7 Day	120 V. 60 C.	86226	86562	83032	45621
	120 V. 50 C.	86307	SEE NOTE 2	83473	45618
	120 V. 25 C.	86227	86563	83474	45609
	240 V. 60 C.	86872	86560	83032	45622
	240 V. 50 C.	86873	86561	83473	
	240 V. 25 C.	87363	87350	83474	45610
30 Day	120 V. 60 C.	86230	86562	83032	45621
	120 V. 50 C.	86874	SEE NOTE 2	83473	45618
	120 V. 25 C.	86875	86563	83474	45609
	240 V. 60 C.	86876	86560	83032	45622
	240 V. 50 C.	86877	86561	83473	
	240 V. 25 C.	87364	87350	83474	45610

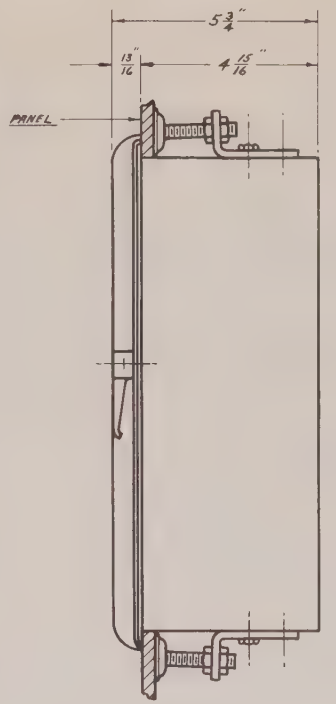
NOTE 1: Use part 86562 with rotor 83033 in place of 83032.

NOTE 2. Use part 86562 with rotor 83473 in place of 83032.

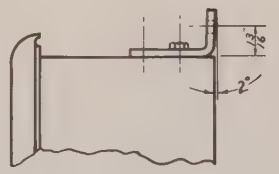
DO NOT SCALE THIS PRINT


10 3/4"
10 5/16" HOLE IN PANEL FOR FLUSH MOUNTING
11/32" (3)
15 5/8" OVERALL
14 3/4" FOR WALL MOUNTING
14 3/8"
13 9/16" HOLE IN PANEL FOR FLUSH MOUNTING
7/8"
2 1/2"
1 9/16"
11/16"
℄ OF CONNECTIONS
5 5/64"
1 13/32"
1 3/32"
1 3/64"
1" R (4)
2
3 7/8"
7 3/4" FOR WALL MOUNTING
ALLOW A SPACE OF 7" FROM SIDE OF OTHER APPARATUS TO ℄ OF THIS INSTRUMENT
ALLOW A SPACE OF 7" FROM SIDE OF OTHER APPARATUS TO ℄ OF THIS INSTRUMENT

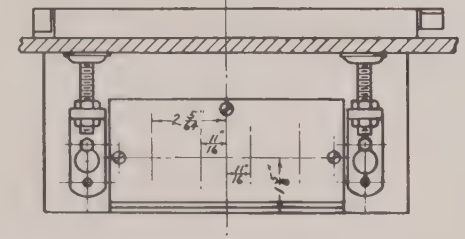
DETAIL OF FLUSH MOUNTED CASE



DETAIL OF WALL MOUNTED CASE



NOTES:-
1. FOR BOTTOM CONNECTED THERMOMETERS AND FOR GAUGES USING CLEANABLE DIAPHRAGM SEAL, INCREASE CUTOUT LENGTH TO 13 3/4" FOR TUBING CLEARANCE IF PANEL IS OVER 1/2" THICK.
2. MAXIMUM PANEL THICKNESS 1 7/8".



MOUNTING DIMENSIONS FOR 8" MODEL 530 CASE

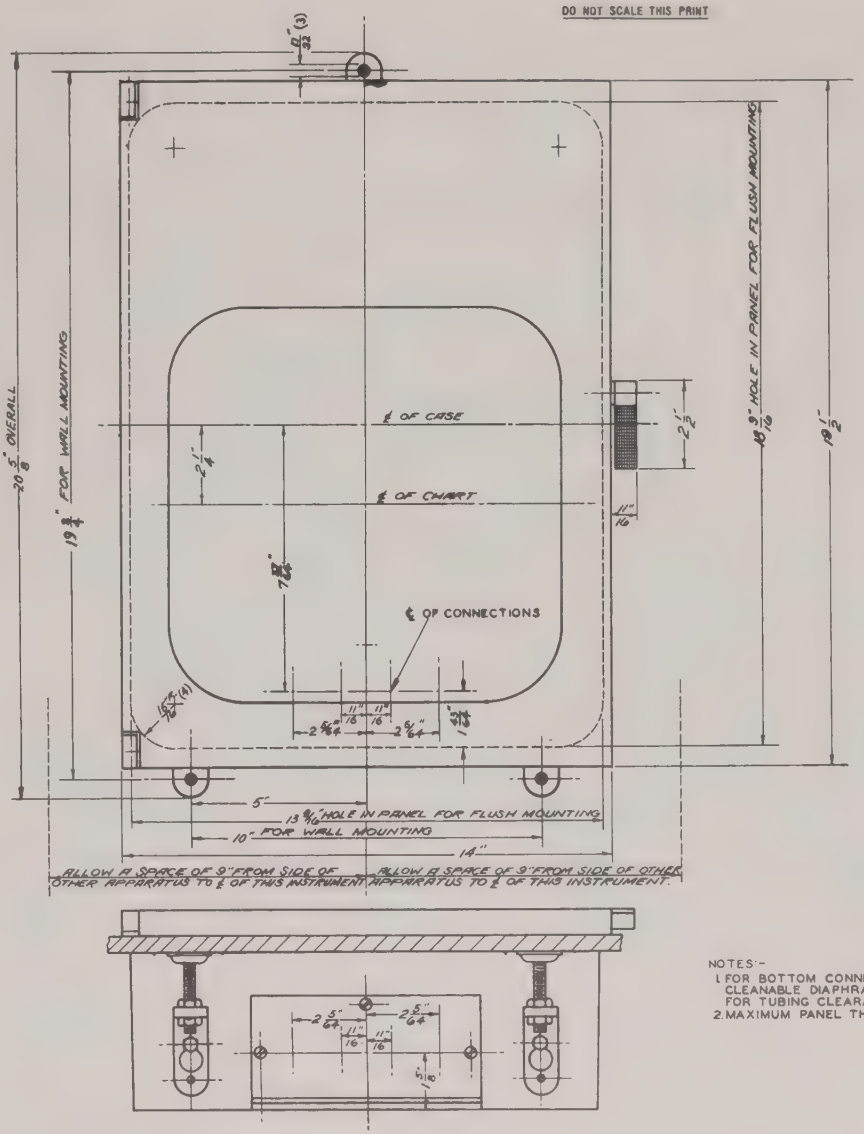
See reverse side for 12" case dimensions

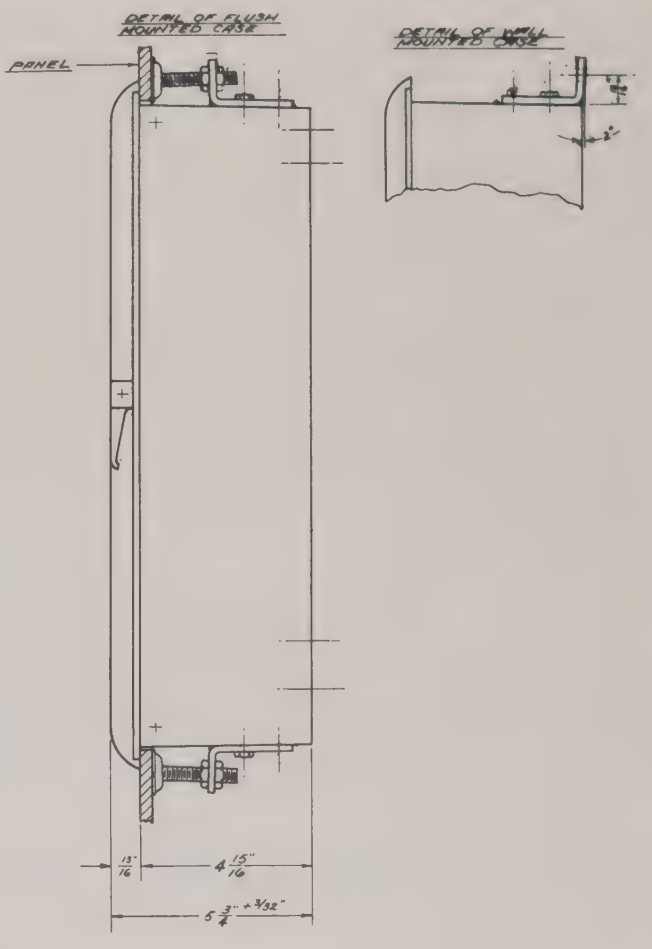
THE BRISTOL COMPANY
WATERBURY 20, CONN., U.S.A.

INSTRUCTION Y19809
Issue No. 4 of 4/53 PAGE 1

THE BRISTOL COMPANY
WATERBURY 20, CONN., U.S.A.

INSTRUCTION Y19809
PAGE 2


DO NOT SCALE THIS PRINT
20 5/8" OVERALL
19 1/4" FOR WALL MOUNTING
℄ OF CASE
℄ OF CHART
℄ OF CONNECTIONS
13 9/16" HOLE IN PANEL FOR FLUSH MOUNTING
19 1/2"
5"
13 9/16" HOLE IN PANEL FOR FLUSH MOUNTING
10" FOR WALL MOUNTING
14"
ALLOW A SPACE OF 9" FROM SIDE OF OTHER APPARATUS TO ℄ OF THIS INSTRUMENT
ALLOW A SPACE OF 9" FROM SIDE OF OTHER APPARATUS TO ℄ OF THIS INSTRUMENT



NOTES:-
1. FOR BOTTOM CONNECTED THERMOMETER AND FOR GAUGES USING CLEANABLE DIAPHRAGM SEAL, INCREASE CUTOUT LENGTH TO 18 3/8" FOR TUBING CLEARANCE IF PANEL IS OVER 1/2" THICK.
2. MAXIMUM PANEL THICKNESS 1 7/8".

MOUNTING DIMENSIONS FOR 12" MODEL 500 CASE

See reverse side for 8" case dimensions

Instruction No. B2030
Issued June 1954

INSTRUCTION NO. B2030

(Issue No. 2 of 6/54)

INSTALLATION, OPERATION AND SERVICE OF BRISTOL'S SERIES 500 AND 534 ELECTRONIC FREE-VANE CONTROLLER

TABLE OF CONTENTS

	Page
PART I GENERAL	3
A. Description	3
B. Types of Control	3
C. How the Electronic Control Unit Works	4
D. How the Proportional-input Unit Works	4
PART II INSTALLATION	5
A. Unpacking and Mounting	5
B. Measuring System	5
C. Wiring	5
PART III OPERATION	5
A. How to Start Controllers	5
B. How to Start Controllers with Proportional-input Control	5
C. Checking and Adjusting the Control Point	7
D. Checking and Adjusting the Differential Gap	7
PART IV SERVICE	7
A. Checking the Tubes	7
B. Replacing a Control Unit	7
C. Servicing of Relay Contacts	7
D. How to Install Change Gears on Proportional-input Units	8
E. Repairs, Correspondence and Shipping	8

THE BRISTOL COMPANY WATERBURY 20, CONN.

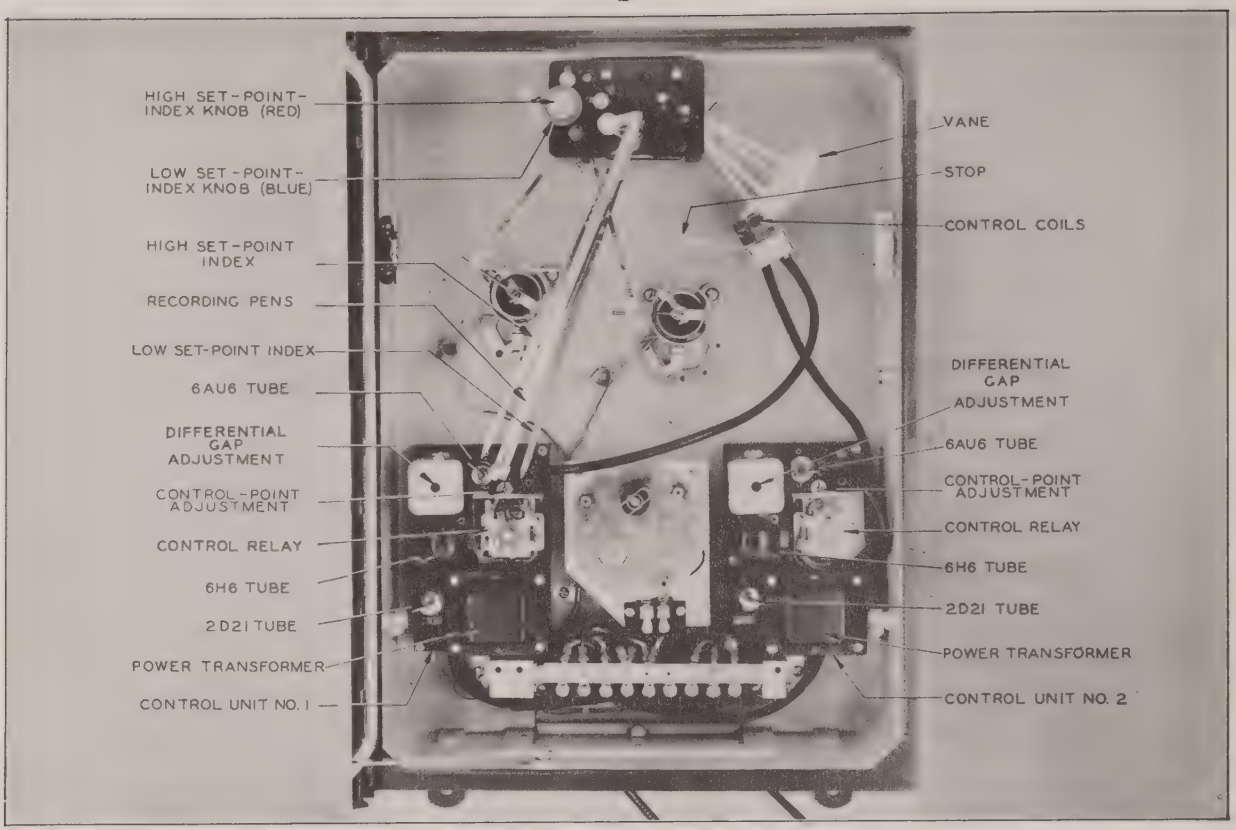


FIGURE 1. RECORDING CONTROLLER WITH TWO CONTROL UNITS

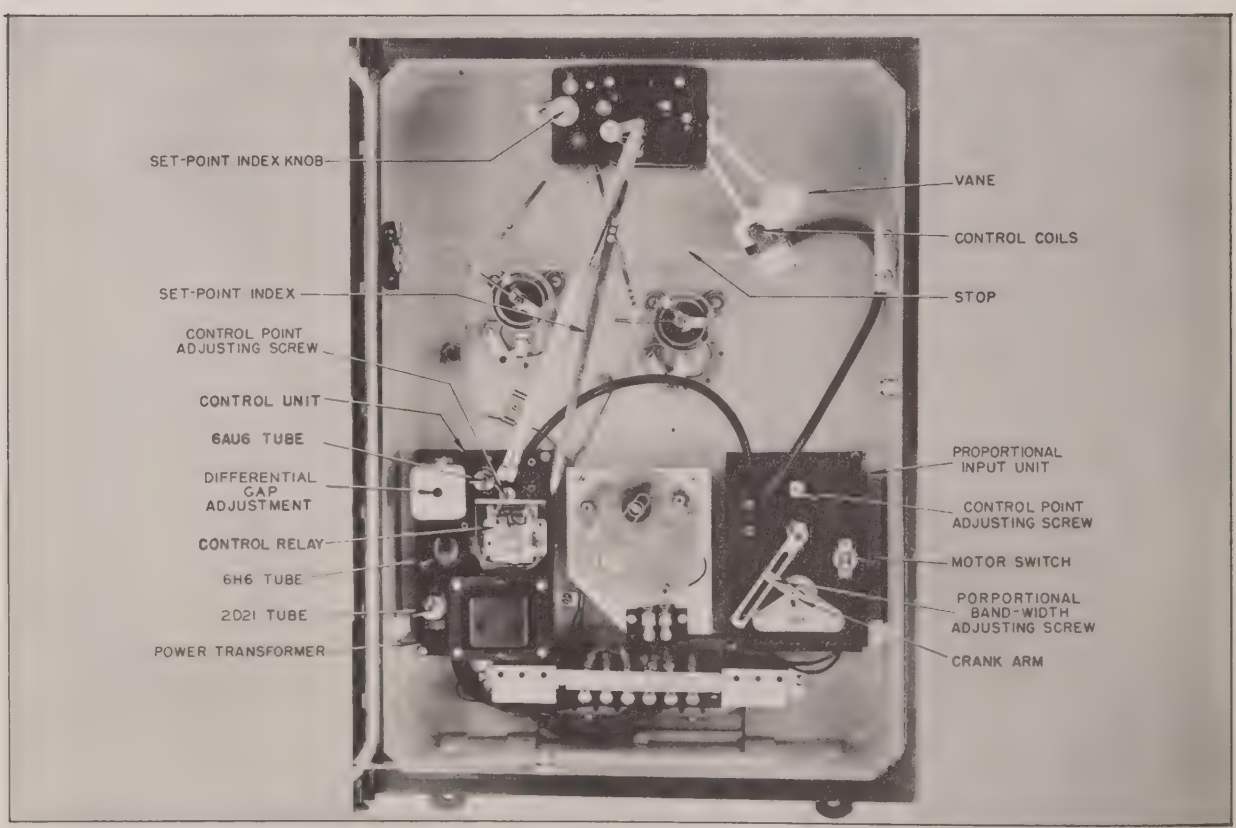


FIGURE 2. RECORDING CONTROLLER WITH PROPORTIONAL INPUT UNIT

Note: This instruction covers only the Electronic Free-vane Control System. See separate instructions covering the measuring system, recording system, etc., which are furnished as required.

PART I GENERAL

A. Description

The Bristol Electronic Free-vane Controller consists of a measuring system (temperature, pressure, flow, etc.) with the necessary indicating or recording components and one or two electronic control units as required.

Controllers with one control unit provide L, H or LH type control and are equipped with one set-point index. Instruments with one control unit may also be equipped with a proportional-input unit.

Controllers with two control units provide LOH or LNH type control and are equipped with two set-point indexes. Two-pen controllers with two control units are sometimes wired to provide an LH type control for each pen. Separate wiring diagrams are furnished to cover these applications.

The electronic units may also be used to operate alarm circuits in instruments such as Bristol's Metameter Receivers.

The electronic control unit and the proportional-input unit are especially adapted for easy installation, interchangeability and simplified service.

B. Types of Control

The Series 500 Electronic Controllers can be furnished with any one of seven standard types of control: L, H, LH, LOH or LNH, and L or H with proportional-input control. Special control circuits are also available on order.

1. L Control. When the measured variable is lower than the set-point index, a **low** control load is energized to raise the measured variable back to the set point. When the measured variable goes above the set-point index, the "L" load is deenergized.

2. H Control. When the measured variable is higher than the set-point index, a **high** control load is energized to lower the measured variable. When the measured variable is lower than the set-point index, the "H" load is deenergized.

3. LH Control. When the measured variable is lower than the set-point index, a **low** control load is energized to raise the measured variable. When the measured variable is higher than the set-point index, a **high** control load is energized to lower the measured variable.

4. LOH Control. When the measured variable is lower than the low set-point index, a **low** control load is energized to raise the measured variable. When the measured variable is between the low and high set-point indexes, both high and low loads are deenergized. When the measured variable is higher than the high set-point index, a **high** control load is energized to lower the measured variable. The band between the low and high set-point indexes is called the **off** band and is adjustable from 0 to 100% of the total range of the instrument.

5. LNH Control. When the measured variable is lower than the low set-point index, a **low** control load is energized to raise the measured variable. When the measured variable is between the low and high set-point indexes, a **normal** control load is energized to maintain the normal value of the measured variable. When the measured variable is higher than the high set-point index, a **high** control load is energized to lower the measured variable. The band between the low and high set-point indexes is called the **normal** band and is adjustable from 0 to 100% of the total range of the instrument.

6. L or H Control with Proportional Input. This type of control is called "average-position action" in which the final control element is turned on and off continuously when the measured variable is within the control band. The ratio of **time on** to **time off** is directly proportional to the deviation of the measured variable from the set-point index. The set-point index usually locates the center of the control band. The control band is adjustable from 0 to 6% of the scale range.

Note: The load or loads may be

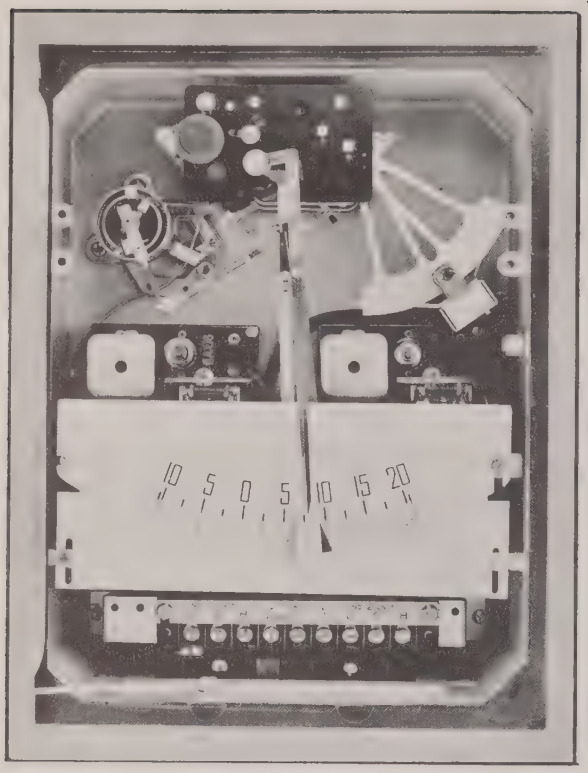


FIGURE 3. INDICATING CONTROLLER WITH TWO CONTROL UNITS

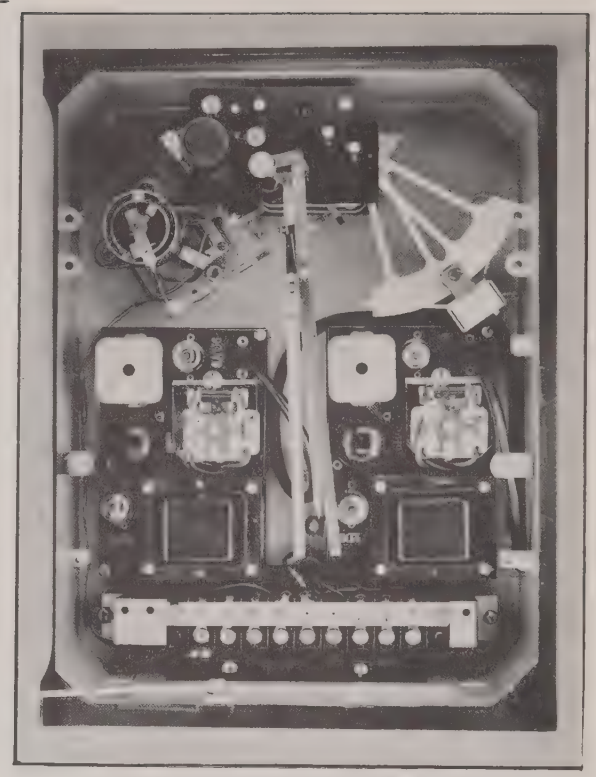


FIGURE 4. INDICATING CONTROLLER WITH TWO CONTROL UNITS

heater units, solenoid valves, coils of motor starters, relays, contactors, etc. Controllers with proportional-input control may be used as L, H or LH controllers merely by putting the band-width adjusting screw on the proportional-input unit in the zero-band position.

C. How the Electronic Control Unit Works

The measuring element of the instrument is connected to a differential mounting to actuate the pen or pointer and a vane. When this vane moves between two control coils, a change occurs in the electronic control circuit that actuates the control relay. The circuit is designed to have the control relay energized when the vane is out of the coils and deenergized when the vane is between the coils. A stop is provided on the control-coil assembly to prevent the vane from going completely thru the coils.

In case of failure of any of the tubes or of failure of the power supply to the instrument, the controller will operate as follows:

On L, H or LH controllers, the controller will operate as though the pen or pointer were above the set point, L circuit open, H circuit closed (control relay deenergized).

On LOH or LNH controllers:

1. If the low control unit fails and the high control unit is OK, the instrument will function as an "LH" controller.

2. If the high control unit fails and the low control unit is OK, the H circuit will close and the L and N circuits will open. This condition will remain until the fault has been corrected.

3. If both control units fail, operation will be the same as in 2 above.

D. How the Proportional-input Unit Works

The proportional-input unit is used together with a single electronic control unit.

The input unit consists of a variable capacitor operated by a Telechron motor. Because the variable capacitor is connected in parallel with the control coils, variation of this capacitance produces the same effect as motion of the vane between the control coils, energizing and deenergizing the control relay.

An adjustable inductance coil is connected across the variable capacitor for adjusting the location of the control point so that the control relay of the electronic control unit will operate when

the pen or pointer coincides with the set-point index in the 0% band position.

The slotted arm on the input unit has positions to give control-band widths of 0%, 1.5%, 3%, 4.5% and 6% of full range of the controller. These percentage values are approximate values because of certain differences between recorders, indicators and program controllers.

When the proportional band is adjusted to zero, the plates of the variable capacitor will remain stationary, the proportional-input unit will have no effect and two-position control will be produced.

When the control band is adjusted to 6%, the proportional-input unit will have its maximum effect.

The effect of moving the plates in the variable capacitor is to swing the control point back and forth once every revolution of the input unit.

The magnitude of this swing and the resulting control-band width depend on the setting of the adjustment mentioned above. As long as the value of the controlled variable is such as to hold the leading edge of the vane within this control band, the final control element will be opened and closed once every revolution. The proportion of opened time to closed time will then depend on the position of the vane edge within this control band. For all values of the controlled variable that are above or below the edges of this control band, the control valve (or other final control element) will be either fully closed or fully open.

PART II INSTALLATION

A. Unpacking and Mounting

See separate instructions furnished covering unpacking and mounting of the Series 500 instruments.

B. Measuring System

See separate instructions covering installation of the measuring system.

C. Wiring

Before making any connections to the instrument, determine what type of control you have (see paragraph B on page 3) and then select the correct diagram from those furnished with this instruction. Special diagrams will be furnished when required. The name plate of the instrument shows what voltage and frequency are to be connected to the a-c power terminals. Note that there are terminals for either 120 volts or 240 volts. Be sure to use the correct terminals. It is suggested that all wiring to the instrument be put in conduit.

Rating of Control Relay Contacts. The relay contacts in the control unit are limited to a non-inductive capacity of 15 amperes at 120 volts, 25, 50 or 60 cycles, 6 amperes at 240 volts, 25, 50 or 60 cycles, and 0.4 ampere at 120 volts d-c.

PART III OPERATION

A. How to Start Controllers

1. Turn instrument power supply on and allow approximately 30 seconds for tubes to warm up.
2. Move set-point index or indexes to the desired value on the chart or scale.
3. Turn load-circuit power supply on. Instrument will then begin automatic control.

B. How to Start Controllers with Proportional-input Control

Controllers with proportional-input control require several operational considerations in addition to those for the standard controller. These are the selection of the correct change gears for the proportional-input unit, the determination of the correct proportional-band width and the starting of the proportional-input unit.

1. Selection of the Correct Change Gears. Change gears are available for three different speeds of rotation of the crank arm: a 15-second cycle, a 30-second cycle and a 60-second cycle. Your proportional-input unit is provided with one set of gears as ordered. Orders that do

not specify any particular speed of rotation will be supplied with gears for a 30-second cycle.

The correct speed depends on the maximum speed with which the controlled variable can change. Use fast gear speeds for a process that can change quickly, such as a small capacity tank, furnace or vat with a relatively large input. Always use the slowest speed which will give satisfactory control. This prevents excessive wear on relays, valves, contactors, etc. However, if too slow a speed is used, the controlled variable will tend to cycle in phase with the proportional-input unit.

See paragraph D on page 8 for instructions on how to install change gears.

2. Determining the Proportional-band Width. The proportional band may be set at 0%, 1.5%, 3%, 4.5% and 6% of the full range of the instrument. This is done by moving the proportional-band-width adjusting screw to any desired position. These positions are shown in Figure 5.

To determine the correct band width for your process, proceed as follows:

First turn instrument power supply **on** and turn input-unit switch **off.** Put the band-width adjusting screw in the 6% position and then turn input-unit switch **on.** Move set-point index to the desired value on the scale. Turn load-

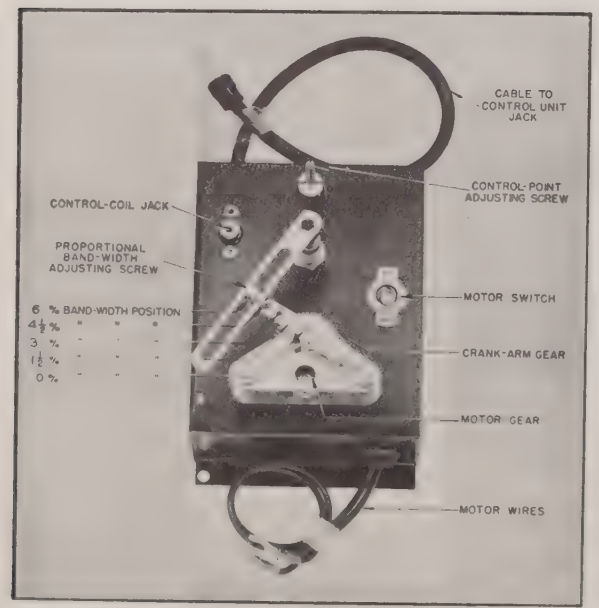


FIGURE 5. PROPORTIONAL INPUT UNIT

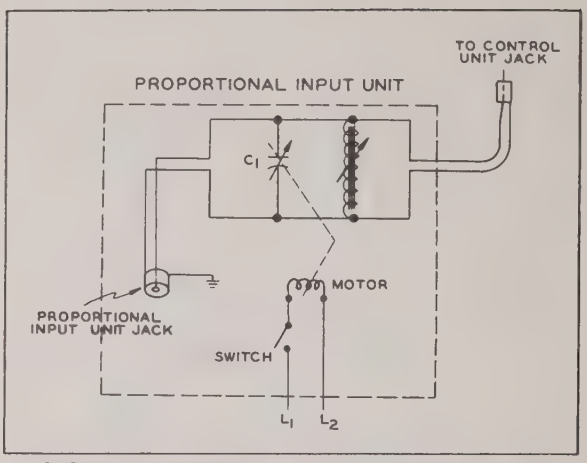


FIGURE 6. SCHEMATIC WIRING OF PROPORTIONAL INPUT UNIT

circuit power supply **on** and allow process to come to a steady condition. When the pen or pointer approaches the set point, automatic proportional control will begin. Observe the action of the pen or pointer for several minutes. The following conditions are possible:

a. The pen or pointer may come up to the control point and remain there. This indicates good control. However, it is desirable to have as narrow a proportional band as possible. Switch off the input unit and change the proportional-band width to 4.5%. Turn on the input unit and again observe the control action. If it is as stable as it was with the 6% band, continue to reduce the proportional-band width until undesirable cycling occurs. This will be indicated by oscillation of the pen or pointer from one side of the control point to the other. To eliminate this oscillation, change the proportional-band width to the next higher value and leave it there.

b. The pen or pointer may cycle in phase with the crank arm when the proportional-band width is set at 6%. This would indicate that the crank-arm speed is too slow for the particular application. Change to a faster speed (see paragraph D on page 8).

c. The pen or pointer may cycle at a frequency different from the crank-arm frequency (usually much slower). This would show that the proportional band is too narrow and that the application of the controller to this particular process was incorrect or that valve sizes, pipe sizes, etc., should be changed.

C. Checking and Adjusting the Control Point

1. Controllers without Proportional-input Control. The control relay should operate when the pen or pointer coincides with the set-point index. This adjustment is very accurately made at the factory and seldom requires readjustment. If readjustment is necessary, turn the control-point adjusting screw (see Figure 1) a little to the left or right as required.

2. Controllers with Proportional-input Control. Remove plug-in cables from control unit and input unit. Plug cable from the control coils directly into the control unit and check the control point exactly as in paragraph 1 above. Then replace plug-in cable from control coils to input unit and plug-in cable from input unit to control unit. Adjust the proportional-band-width adjusting screw in the zero hole of the crank arm so that the slotted arm remains perfectly vertical. Again check the control point exactly as in paragraph 1 above. If any adjustment is necessary, adjust the control-point adjustment on the proportional-input unit (not the control-point adjustment on the control unit).

D. Checking and Adjusting the Differential Gap

Differential gap (dead zone) applying to two-position controller action (LH control) is the smallest range of values thru which the controlled variable must pass in order to move the final control element in succession to both of its fixed positions. This zone is set at the factory at approximately .003" and seldom requires readjustment. However, when the instrument is subject to excessive vibration, it may be necessary to widen the differential gap in order to prevent erratic operation of the controller.

To check the width of the differential gap, move the set-point index slowly past the pen or pointer (both upscale and downscale) and note when the control relay operates. If readjustment is required, it may be done by adjusting the differential-gap adjustment (see Figure 1) with a screwdriver. Turn the adjusting screw counterclockwise to widen the differential gap or clockwise to narrow the gap. Check the control point after any change in the differential gap.

Control units shipped after June 1, 1954 permit a differential-gap adjustment up to .012". Control units made previous to this date have a maximum gap of approximately .004". These older units may be easily altered in the field to permit a wider differential gap by adding a 270,000 ohm resistor (Bristol Part 90557) across the discriminator transformer secondary (lugs A and C on schematic wiring diagram)

PART IV SERVICE

A. Checking the Tubes

If your controller fails to function properly and there is no obvious fault (such as power failure, measuring-element failure, etc.), check the electronic tubes by replacement (a spare set should always be kept on hand). Remove one tube at a time from the control unit and replace it with one known to be good. Allow 30 seconds for the tube to warm up. When operation is restored, the original good tubes may be reinstalled. If normal operation is not obtained with a complete new set of tubes, the control unit should be replaced by one known to be good. When replacing a unit, leave the old tubes in the old unit.

Note: The vacuum tubes used are standard types and may be purchased in any radio supply store.

B. Replacing a Control Unit

To remove a control unit, disconnect the wires connecting the unit to the terminal block and remove the plug-in cable from the control coils or input unit as the case may be. After removing the mounting screws, the unit may be easily removed from the case. Install the new unit, replace and tighten the mounting screws and connect the wires as per wiring diagram.

After the new unit has been installed, check its control point and differential gap as outlined in Part III, paragraphs C and D.

C. Servicing of Relay Contacts

The relay contacts should be cleaned and burnished (with crocus cloth) as often as experience shows it to be necessary.

Crank-arm Rotation (Seconds)	Crank-arm Gear		Motor Gear	
	Number Of Teeth	Part Number	Number Of Teeth	Part Number
15	30	67856	30	67856
30	40	47693	20	47696
60	48	45319	12	53490

FIGURE 7. TABLE OF GEARS FOR INPUT UNIT

D. How to Install Change Gears on Proportional-input Units

To install new change gears, remove the proportional-band adjusting screw (note which hole it is in), swing the slotted arm out of the way and take off the top bearing plate (including the crank arm, shaft and gear). Remove the crank-arm gear and motor gear. See Figure 7 for identification and listing of gears.

For a 15-second cycle the two change gears have an equal number of teeth (30). For the 30- and 60-second cycle the larger gear always goes on the crank-arm shaft. After sliding the new gears on their respective shafts, replace the top bearing plate. Position the crank-arm gear on its shaft so that it clears the bottom bearing plate by at least 1/16". Tighten its setscrew. Then position the motor gear so that it meshes properly with the crank-arm gear. Tighten its setscrew. Replace the proportioning-band adjusting screw in the same hole from which it was originally removed.

E. Repairs, Correspondence and Shipping

If your electronic controller cannot be repaired with the information furnished in this instruction, it should be shipped to the nearest Bristol Company Branch or Main Factory for repair or replacement. **Do not** ship instrument to Branch Offices.

Send all parts for repair or exchange to Branch or Main Factories only, never to Branch Offices. Identify your shipment fully, including your exact return address and repair order number.

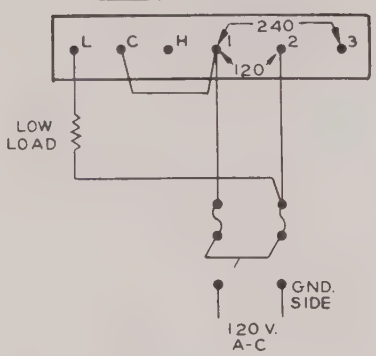
Send all correspondence and orders to the nearest Branch Office. Addresses and phone numbers of Bristol's Field Organization are listed on last pages of all instruction books.

Be sure to state model and serial number of instrument in all orders and correspondence.

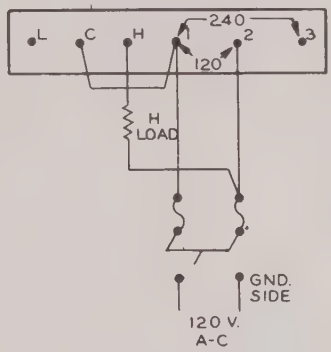
The Bristol Company
Waterbury 20, Conn.

Printed in U.S.A.

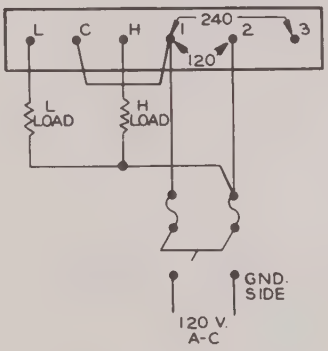
L-TYPE CONTROL



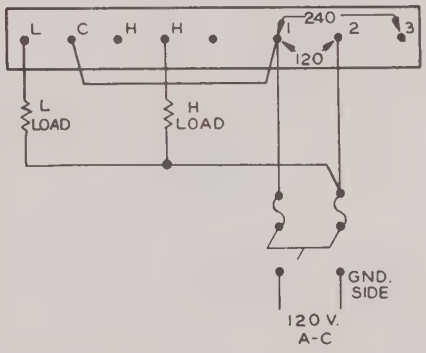
H-TYPE CONTROL



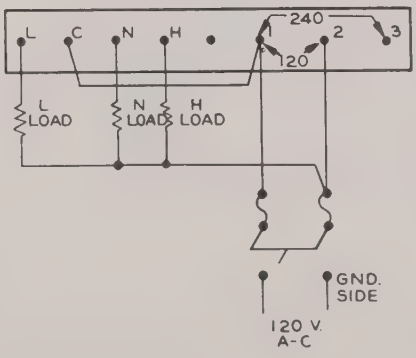
LH-TYPE CONTROL



LOH-TYPE CONTROL



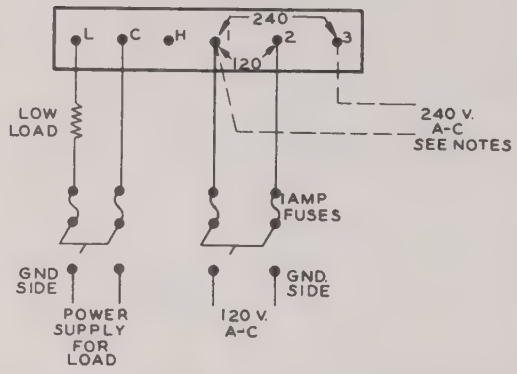
LNH-TYPE CONTROL



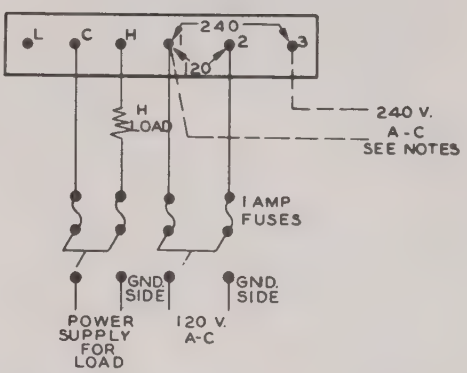
NOTES:-
1. FUSED LINE SWITCHES FURNISHED BY CUSTOMER.
2. LOAD CIRCUIT CONTACTS IN CONTROLLER ARE LIMITED TO A NON-INDUCTIVE CAPACITY OF 15 AMPS. AT 120 V. A-C OR 6 AMPS. AT 240 V. A-C

EXTERNAL WIRING DIAGRAM
SERIES 500 ELECTRONIC CONTROLLERS
WITH COMMON 120 V. A-C SUPPLY FOR INSTRUMENT AND LOADS

L-TYPE CONTROL



H-TYPE CONTROL



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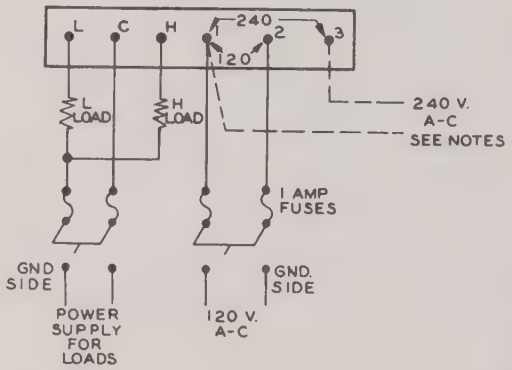

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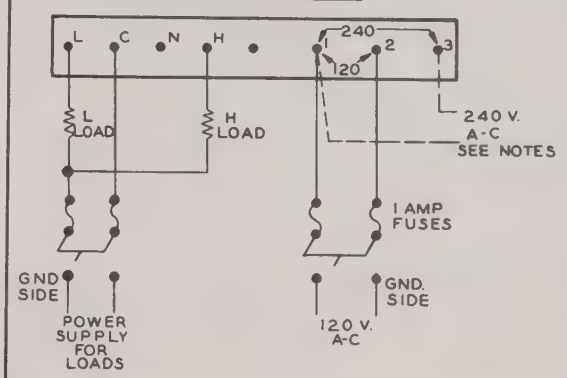
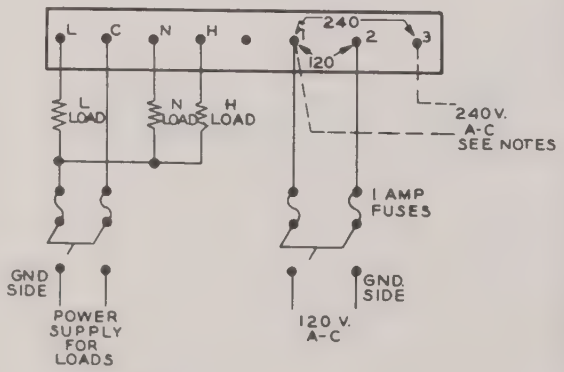


LNH-TYPE CONTROL

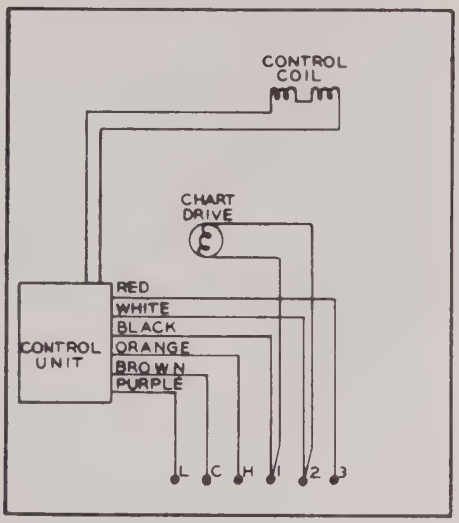


NOTES:-

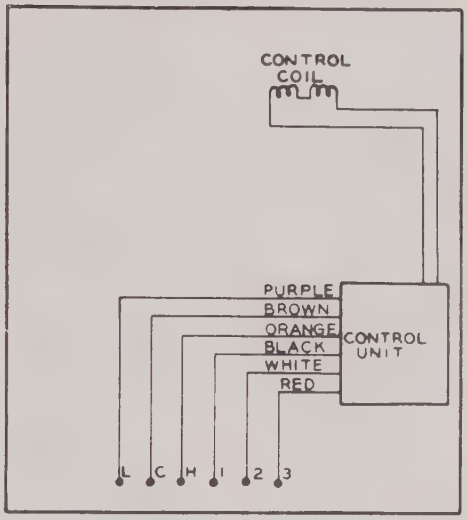
1. THE POWER SUPPLY TO THE CONTROLLER MAY BE EITHER 120 VOLTS OR 240 VOLTS A-C.
2. FUSED LINE SWITCHES FURNISHED BY CUSTOMER.
3. LOAD CIRCUIT CONTACTS IN CONTROLLER ARE LIMITED TO A NON-INDUCTIVE CAPACITY OF 15 AMPS. AT 120 V. A-C OR 8 AMPS. AT 240 V. A-C.

EXTERNAL WIRING DIAGRAM
SERIES 500 ELECTRONIC CONTROLLERS
WITH SEPARATE SUPPLY FOR INSTRUMENT AND LOADS

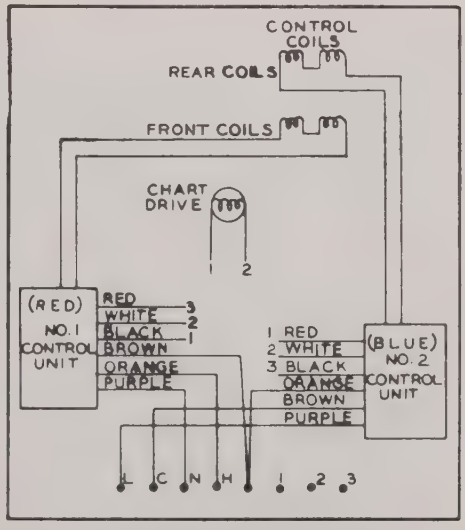
RECORDER WITH SINGLE CONTROL UNIT



INDICATOR WITH SINGLE CONTROL UNIT



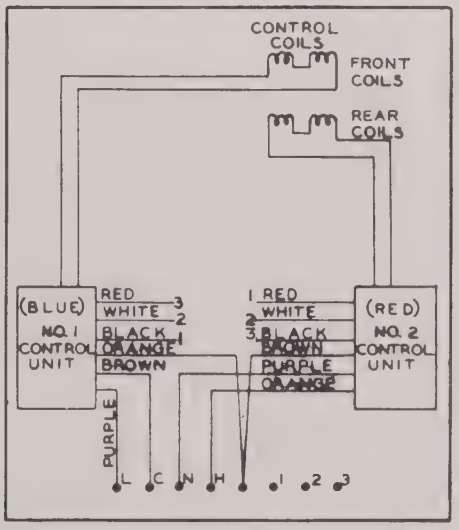
RECORDER WITH TWO CONTROL UNITS



NOTE: REAR VANE LEADS FRONT VANE INTO CONTROL COILS.

RECORDER WITH FIXED 2% BAND & 2 CONTROL UNITS

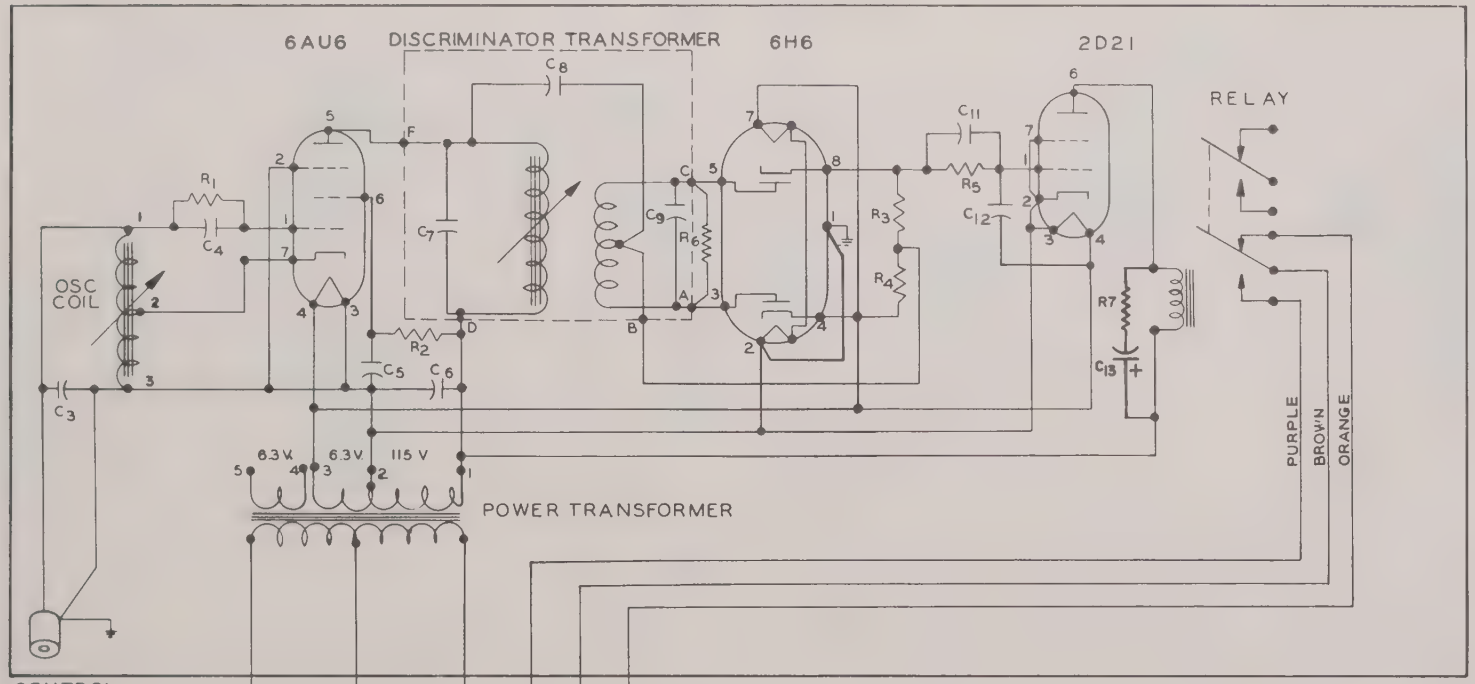
INDICATOR WITH TWO CONTROL UNITS



NOTE: FRONT VANE LEADS REAR VANE INTO CONTROL COILS.

INTERNAL WIRING OF STANDARD SINGLE & DOUBLE CONTROL UNIT SERIES 500 ELECTRONIC CONTROLLERS EQUIPPED WITH 1959 DESIGN DIFF. PEN MOUNTINGS FOR SERIAL NO. 719296 & ABOVE

ELECTRONIC CONTROL UNIT



C_3	55 MICRO-MICROFARADS
C_4	39 MICRO-MICROFARADS
C_5	750 MICRO-MICROFARADS
C_6	750 MICRO-MICROFARADS
C_7	SUPPLIED WITH
C_8	DISCRIMINATOR
C_9	TRANSFORMER

C_{11}	05 MICROFARAD
C_{12}	750 MICRO-MICROFARAD
C_{13}	8 MICROFARAD
R_1	15,000 OHMS
R_2	47,000 OHMS
R_3	150,000 OHMS
R_4	270,000 OHMS
R_5	2.2 MEGOHMS
R_6	270,000 OHMS
R_7	270 OHMS

SCHEMATIC WIRING OF CONTROL UNIT

THE BRISTOL COMPANY
Waterbury 20, Conn., U.S.A.

BRISTOL'S SERIES 500 AND 534 ELECTRONIC FREE-VANE CONTROLLERS

(APPLIES TO SERIAL 719296 AND ABOVE)

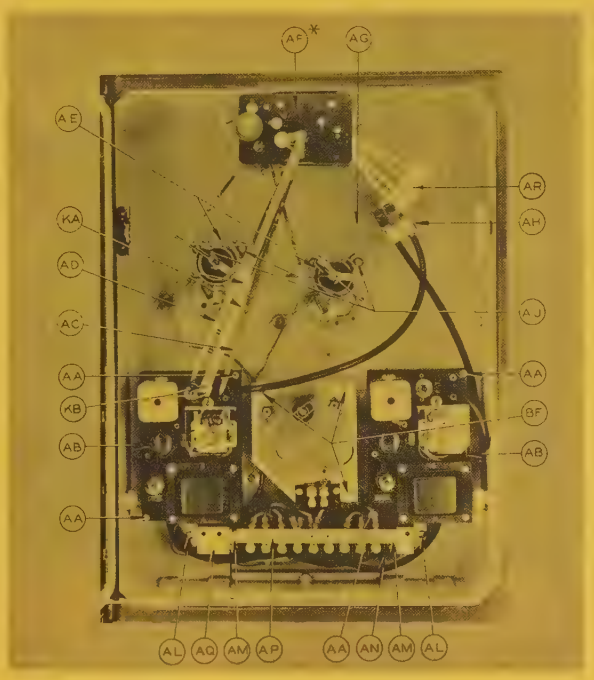


FIGURE 1. 12" TWO PEN RECORDER WITH TWO CONTROL UNITS

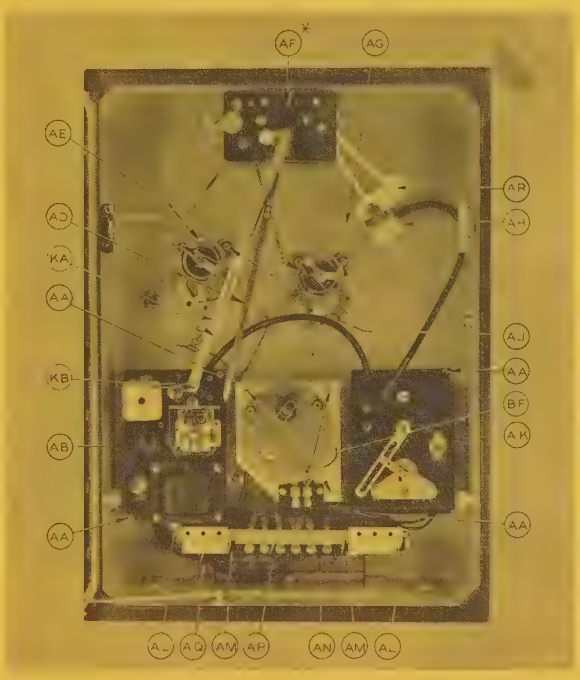


FIGURE 2. 12" TWO PEN RECORDER WITH PROPORTIONAL INPUT UNIT

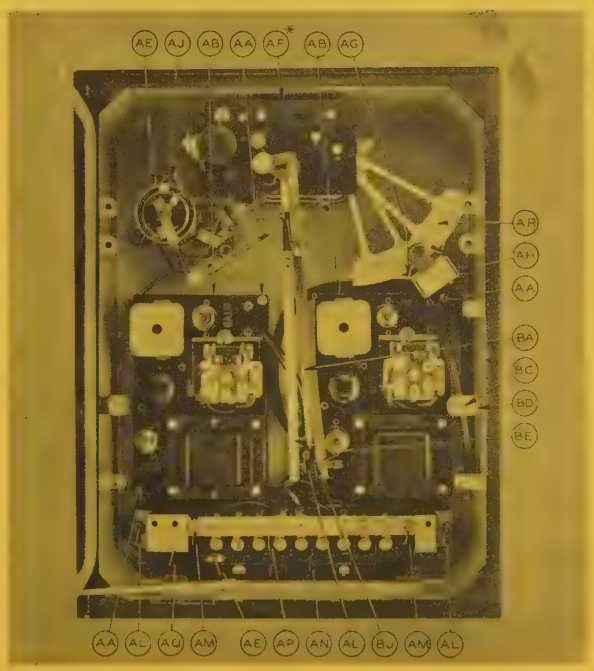


FIGURE 3. 8" TWO UNIT INDICATOR WITH DIAL PLATES REMOVED

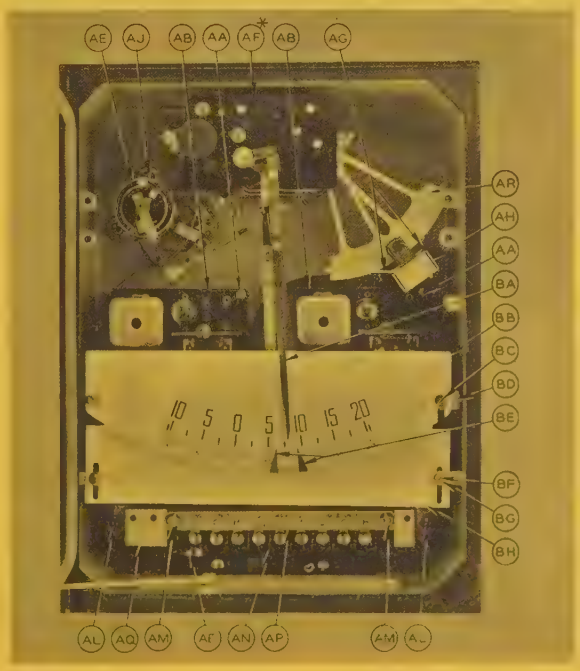


FIGURE 4. 8" TWO UNIT INDICATOR

*NOT EXACTLY AS SHOWN

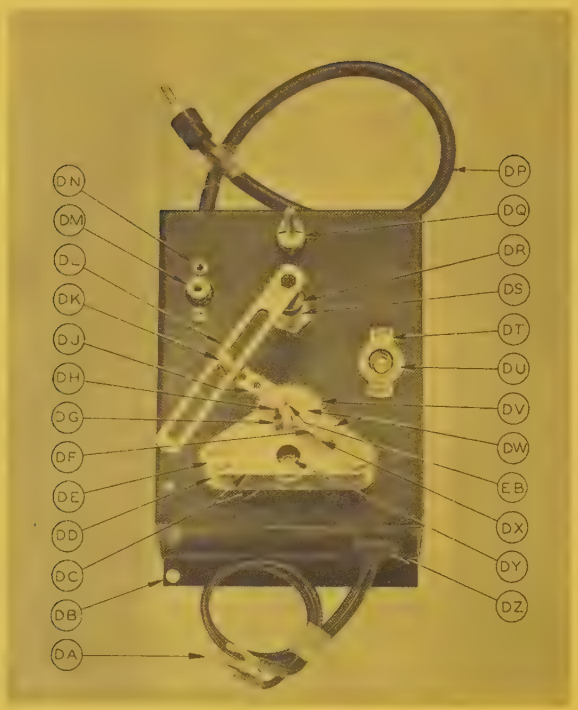


FIGURE 5. INPUT UNIT - FRONT VIEW

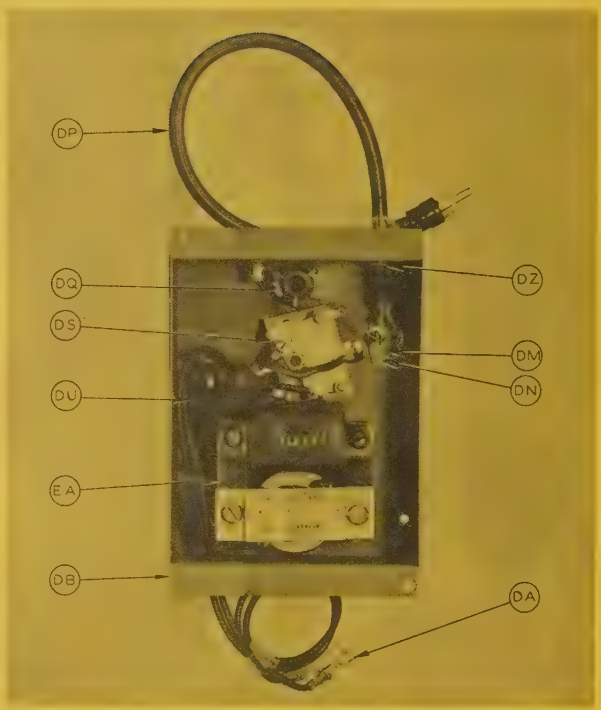


FIGURE 6. INPUT UNIT - BACK VIEW

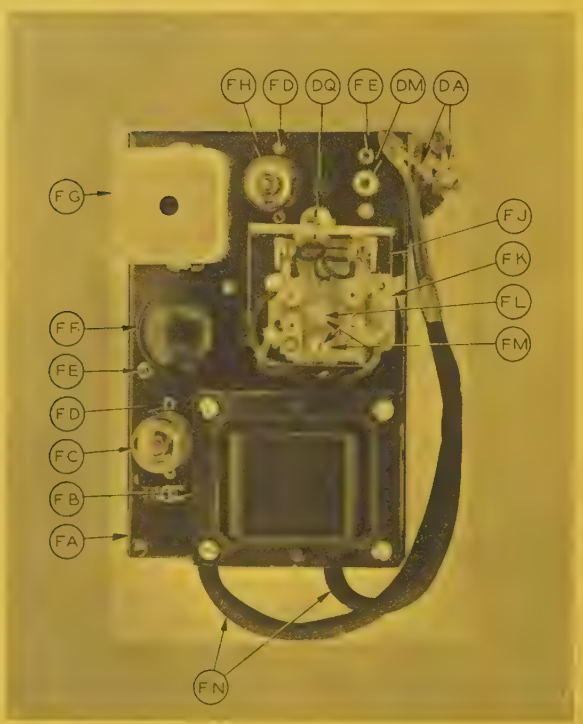


FIGURE 7. CONTROL UNIT - FRONT VIEW

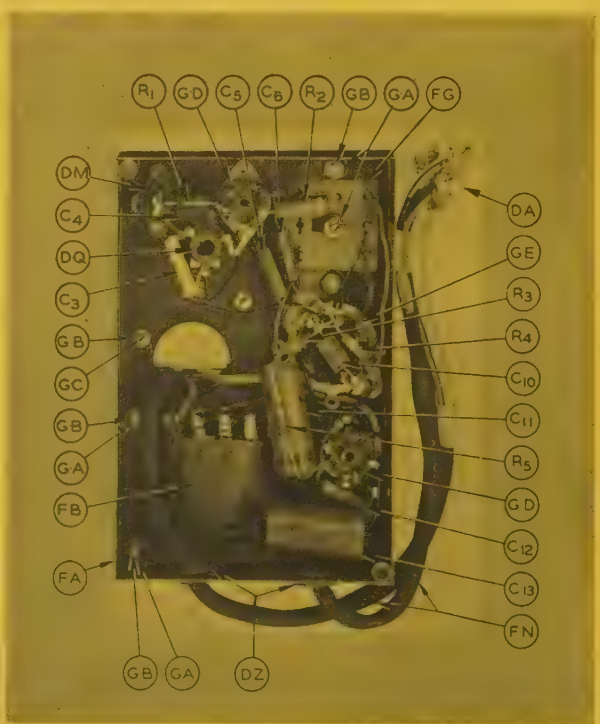


FIGURE 8. CONTROL UNIT - BACK VIEW

CAPACITORS AND RESISTORS FOR CONTROL UNIT

ITEM	DESCRIPTION	PART NO.
C_3	Capacitor - 55 mmfd - 500 volts d-c	91431
C_4	" - 39 mmfd - 500 volts d-c	90562
C_5	" - 750 mmfd - 500 volts d-c	90560
C_6	" - 750 mmfd - 500 volts d-c	90560
C_{10}	" - 2 mmfd - 500 volts d-c	90563
C_{11}	" - .05 mfd - 400 volts d-c	77701
C_{12}	" - 750 mmfd - 500 volts d-c	90560
C_{13}	" - 8 mfd - 250 volts d-c	92727
R_1	Resistor - 15,000 ohm - 1/2 watt	90556
R_2	" - 47,000 ohm - 1 watt	83977
R_3	" - 150,000 ohm - 1/2 watt	87019
R_4	" - 270,000 ohm - 1/2 watt	90557
R_5	" - 2.2 megohn - 1/2 watt	89087
R_6	" - 270,000 ohm - 1/2 watt	90557
R_7	" - 270 ohm - 2 watt	A2886

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	DESCRIPTION	PART NO.
AA	8-32 x 1½" Fillister-head screw for control unit	90670
	8-32 x 1/4" Fillister-head screw for input unit	40066
Not Shown	Washer under screw for recorder	92965
AB	Electronic control unit complete (for breakdown of parts see Figures 7 and 8):	
	For 120 or 240 volts, 50-60 cycles	90578
AC	Low set-point index	90653
AD	High set-point index	90652
	Single set-point index	90652
AE	Measuring element:	
	Thermometer system including measuring element, bulb, mounting sleeve, and tubing must be replaced or repaired as a unit. For repairs, system must be returned to The Bristol Company. In either case, give model, serial and chart numbers of instrument.	
	Pressure system. For replacement of pressure system including measuring element, tubing, and connection mounting, give model, serial, and chart numbers of instrument.	
AF	Differential pen mounting complete (Not exactly as shown)	
	For 8" single-control-unit indicator	C1831
	For 8" double-control-unit indicator	C1829
	For 12" single-control-unit 1-pen recorder	C1830
	For 12" single-control-unit 2-pen recorder	C1832
	For 12" double-control-unit 1-pen recorder	C1833
	For 12" double-control-unit 2-pen recorder	C1828
Not Shown	10-32 x 3/4" Fillister-head screw for mounting Item AF	66545
AG	Stop bracket mounted to left of control coil	90648
	Stop bracket mounted to right of control coil	90647
Not Shown	4-48 x 1/4" Fillister-head screw for mounting Item AG	61247
AH	Control coil and mounting complete - not including stop bracket:	
	For single-control-unit instrument	B2213
	For double-control-unit recorder	B2212
	For double-control-unit 8" indicator (specify with cover 92240)	B2212
Not Shown	10-32 x 1/4" Fillister-head screw for mounting Item AH	66537
AJ	10-32 x 3/8" Fillister-head screw for mounting measuring element	66539
AK	Proportional-input unit complete (for breakdown of parts see Figures 5 and 6):	
	For 60-second rotation, 50 or 60 cycles	91400
	For 30-second rotation, 50 or 60 cycles	91420
	For 15-second rotation, 50 or 60 cycles	91424
AL	10-32 x 1/4" Fillister-head screw	66537
Not Shown	Mounting post for indicator	90656
AM	8-32 x 1" Self-tapping screw	86722
Not Shown	Spacer	72166
AN	Terminal block (6 terminals)	87238
	Terminal block (9 terminals)	85288
AP	Terminal marking strip (LCH123)	90696
	Terminal marking strip (LCH123LCH or LCNH..123)	90654
AQ	Terminal-block mounting bracket	76253
AR	Vane	A5774
BA	Indicating pointer	90697
BB	Scale plate - order by model and serial numbers of instrument	
BC	10-32 x 1/4" Special-head screw	39425
BD	Bracket	86751
Not Shown	6-40 x 1/4" Fillister-head screw for bracket item BD	39770
BE	Control index - high	90698
	Control index - low	90699
	Control index - single	90804
BF	6-40 x 1/4" Fillister-head screw	39770
BG	Washer	6965
BH	Dial plate	86724
BJ	Mounting bracket	90807
DA	Terminal	83882
DB	Chassis	91413
DC	Bearing plate	91402
DD	Post	91403
DE	10-32 Shoulder screw	89048
DF	Split hub (.125" shaft)	65957
DG	1-72 x 3/32" Hex-head screw	67694
DH	Washer	91409
Not Shown	Collar	42956
	6-40 x 1/8" Flat-point setscrew	82403
DJ	Arm	91406

BE SURE TO STATE MODEL AND SERIAL NUMBERS OF INSTRUMENT WHEN ORDERING PARTS

ITEM	DESCRIPTION	PART NO.	
DK	Stud	91412	
DL	Slotted arm	91407	
DM	Socket	91980	
DN	Eyelet	65100	
DP	Cable	91408	
DQ	Oscillator coil	90569	
DR	Collar	93848	
	2-64 x 1/16" Spline Cup-point setscrew	.....	
DS	Variable capacitor complete including Item DR but not:	91401	
	Lockwasher between capacitor and chassis	79844	
DT	Switch plate	63786	
DU	Switch including connecting wires	88365	
DV	Change gear (driven) including setscrews Item HH:		
	48 Teeth	45319	
	40 Teeth	47693	
	30 Teeth	67856	
DW	1-72 x 1/4" Flat-head screw	22680	
Not Shown	Spacer	91405	
DX	Eyelet	25571	
Not Shown	Leaf spring	91410	
DY	Change gear (driving) including setscrews Item HH:		
	12 Teeth	53490	
	20 Teeth	47696	
	30 Teeth	67856	
DZ	Grommet	79767	
Not Shown	Snap ring between grommet and chassis	72403	
EA	Telechron motor - 120 volt, 50 or 60 cycle	45183	
EB	Shaft	91404	
FA	Chassis	90552	
FB	Power transformer for 120-240 volt, 50-60 cycle	90576	
FC	2D21 Tube	90555	
FD	Eyelet	92360	
FE	Eyelet	92359	
FF	6H6 Tube	90553	
FG	Discriminator transformer	90573	
FH	6AU6 Tube	90554	
FJ	Relay protection plate	91521	
FK	Relay	90570	
FL	4-36 x 3/16" Fillister-head screw	91883	
FM	Lockwasher	45692	
FN	Insulating tubing	86252	
GA	6-32 Hex nut	92923	
GB	#6 Lockwasher	33982	
GC	6-32 x 5/16" Fillister-head screw	63384	
GD	Miniature socket	87029	
GE	Octal socket	71708	
KA, KB	Pens and Pen Arms:		
	For Single-Pen Recorder		
	Fountain-pen arm (marked FG)	90650	
	V-pen arm (marked FE)	83728	
	Fountain pen	32914	
	V pen	42648	
	For Two-Pen Recorder		
	Pen arm nearer chart (marked FG)	90650	
	Pen arm farther from chart (marked FH)	90651	
	Pen nearer chart	32914	
	Pen farther from chart	32915	

Instruction W-18220
Issued April 1954

HOW TO ORDER PARTS AND SUPPLIES FOR BRISTOL PRODUCTS

In all correspondence concerning any product of the Bristol Company, always give the model and serial number of the product concerned. Send your purchase order or quotation request to the nearest Bristol Company Branch Office (see the back of this sheet for addresses).

REPLACEMENT PARTS

When ordering replacement parts look up the part name and number in the parts list provided with the instructions that came with your product. When you cannot find a part number, give an accurate description of the part. If you have mislaid your parts list write for a new one giving the model and serial number of the product.

CHARTS

In ordering charts for recorders, give the chart number (printed on the chart and also on the instrument name plate).

Avoid inconvenient emergency orders by keeping a six months supply of charts on hand for each of your recorders.

THERMOCOUPLES

Pyrometer thermocouples should be ordered from Bulletin P-1238. Be sure to specify the catalog number and the length. If you do not have Bulletin P-1238, write for one.

Pyrometer users should always have a supply of spare thermocouples.

SAMPLE PURCHASE ORDER:

QUANTITY REQUIRED	DESCRIPTION	PART, CHART OR CATALOG NUMBER
1000	Charts, 0° to 1500°F	5342
5	7-day electric chart drive for 115 volts, 60 cycles	86226
4	Pen arms marked CD	49703
1	Knurled plastic knob on outside of case, ½" diameter, 3/16" hole for moving set-point index	none given
1	1 oz. bottle red ink	6883
	The above parts are for a Bristol thermometer controller Model 1T1X500B-2, serial number 767211.	
4	IC thermocouples, length 30"	3BS14N2
	The above thermocouples are for a Bristol pyrometer Model 487-L, serial number 202953	

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